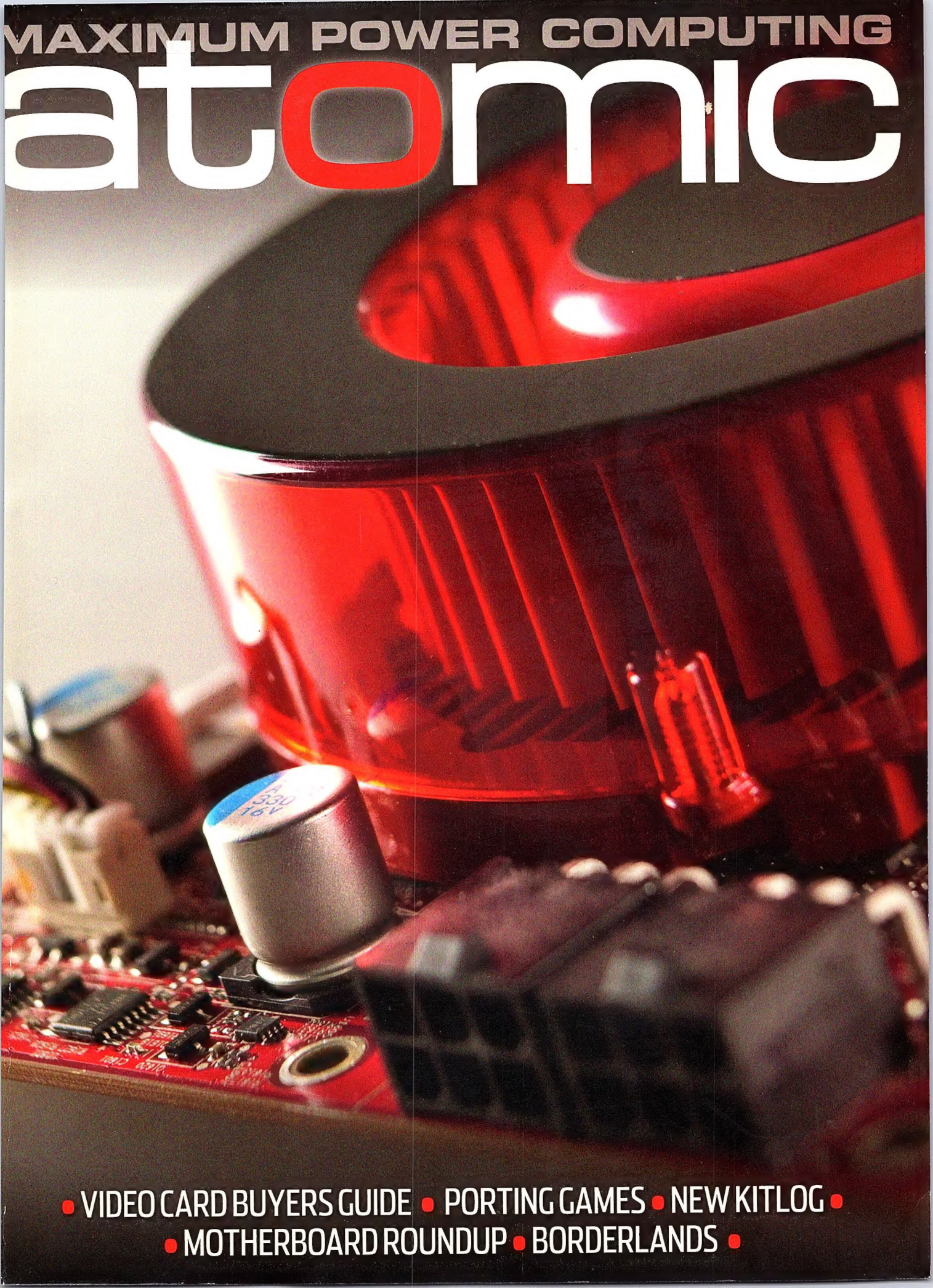


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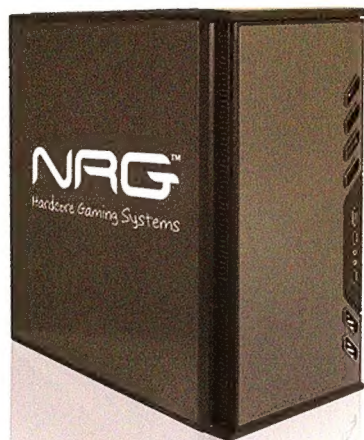


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ED HEAD

New builds, new faces.

We're starting a little mini revamp this issue.

In our recent Hot 100 poll we discovered that one of the most popular parts of the magazine was the KitLog, our selection of top choices for three different PC builds. That was surprising enough, and when I floated on our forums (right here, in fact: <http://forums.atomicmpc.com.au/index.php?showtopic=17997>) that we were thinking of re-vamping the venerable section, it fired some considerable passion!

But it was very useful passion, and you'll find the fruits of that labour this issue. The section spread from two pages to four, and now has four builds - our basic, bare minimum Atomic-grade spec, the money-is-no-obstacle build, a LAN box, and a home theatre box. Something for everyone, really, and the components are pretty easy to swap about if you want to fiddle with our choices.

Of course, if you have your own ideas on what makes the perfect PC, let us know. Email us, or, better yet, let us know on the forums - <http://forums.atomicmpc.com.au>.

Change is also in the air with X-ray this month. Ashton Mills delivered his usual masterpiece of science and cool, but, sadly, it's also his last X-ray! Ashton's a bona-fide Atomic champion, having written for the mag since the early days, and had his own run in the Editor's chair. He's not going to be completely absent, however - he'll still be doing his column, Technica Obscura each month at least.

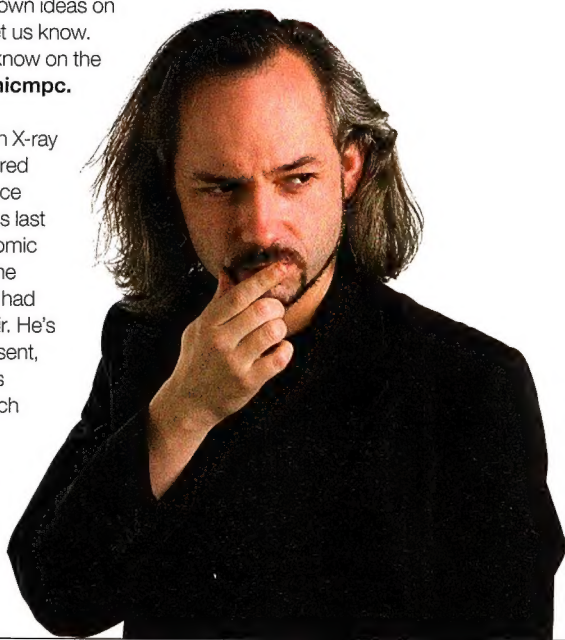
Regardless, I hope you'll all join me in thanking Ashton for being such an outstanding tech writer. Bravo, my good man!

Sad as it is, though, it's

also an opportunity. From next issue, we'll be filling Ashton's not inconsiderable shoes with two great writers - James Matson and Jake Carroll, names that should be familiar to any longterm reader. With Jake's love for big iron, heavy storage and all manner of GIANT TECH, I expect some mind-bending pieces. From James, well, it'll just be plain mind-expanding.

And with such good writers, X-ray's going to get a slight facelift, too... fun times for Atomic, fun times for you.

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Meet Intel's Lynnfields

The latest additions to Intel's extended Core i5 processor family.

Intel's upcoming Lynnfield processor family has now been given its nom de guerre by Intel and will reach the market just in time for the back-to-school frenzy.

According to HKEPC the offer consists of three processors in both the Core i5 and Core i7 class, that will get into integrator boxes by 6 September. A couple of S-series low-power quads (which aren't very low-power at all) will also make it to market by Q1 2010. The site has compiled a table to show just how the labels will go on the processors...

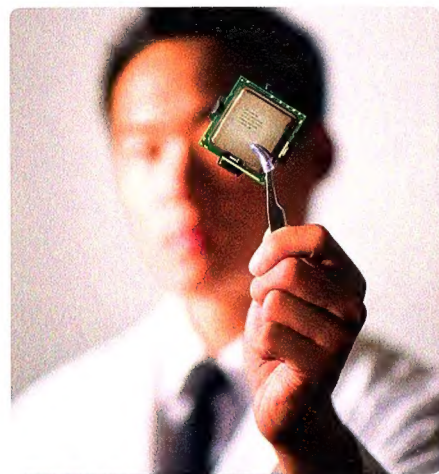
- \$US562 Core i7 870 2.93GHz (3.6GHz) processor, quad-core hyper-threaded processor with 95W TDP.
- \$US284 Core i7 860 2.8GHz (3.46GHz) processor, quad-core hyper-threaded processor with 95W TDP.

- \$US196 Core i5 750 2.66GHz (3.2GHz) processor, quad-core, no HT, 95W TDP.
- \$US337 Core i7 860s 2.53GHz (3.46GHz) processor, quad-core, hyper-threaded processor with 82W TDP.
- \$US259 Core i5 750s 2.4GHz (3.2GHz) processor, quad-core, no HT, 82W TDP.

Common to all Lynnfield processors is that you'll bung them into LGA 1156 sockets and have an integrated dual-channel memory controller that supports DDR3 1333. And you can up the CPU clock with Turbo Boost (speed in brackets). There's no prediction on how this impacts power consumption, though.

Core i5s don't support VT-d (direct I/O), but VT-x, TXT, ESIT and Intel 64 are supported in all Lynnfields.

Turbo Boost has the distinct ability to



overclock all cores equally, or a single core to fairly high values. The number listed in brackets is most likely the single core boost, rather than the overall boost. Still, a fair overclock on tap.

So there you have it, Mr and Mrs Lynnfield, their little boy and the toddlers that will spawn forth in Q1 2010.



Production IG + Halo = WIN!

Halo - love it or hate it, you've got to admit that game, and the its main character, have had a pretty huge impact on gaming. The Master Chief came tantalisingly close to getting full motion picture telling his power-armoured tale, but that fell through. Now, though, Microsoft has announced some big, anime-themed plans for everyone's favourite Spartan.

Five Japanese anime studios are going to be producing seven Halo short features for release on Xbox Live later this year. The studios are a who's who of anime gold - Bones, Casio Entertainment, Studio4[Degrees]C, Toei Animation and Production I.G. (the studio behind the awesomely cool Ghost in the Shell films and series). Even more exciting, the whole project is being overseen by Shinji Aramaki, the director of the two latest Appleseed films.

The movies will later be released, via Warner Bros, on DVD and Blu-ray in 2010.

The project will come under the umbrella of the new home of all things Halo: 343 Industries, a new Microsoft division.

FROM ATOMIC
ONLINE

It's another good month of techy fun on the Atomic forums, and that means lots of good posts to choose from for our Post of the Month. But there's one clear winner...

nesquick! With his mobile GPU tweaking piece (plus, maybe, some tweaking of other parts!).

<http://forums.atomicmpc.com.au/index.php?showtopic=17558&st=0&entry347625>

And of course, there's a host of special mentions!

chvzding details how to eat like a king on a pauper's income.

<http://forums.atomicmpc.com.au/index.php?showtopic=18042&st=0&p=356466#entry356466>

A great one from newcomer *michael.jenkin* on the world of Microsoft.

<http://forums.atomicmpc.com.au/index.php?showtopic=17716&view=findpost&p=359290>

Essential car-buying advice from *the dude*.

<http://forums.atomicmpc.com.au/index.php?showtopic=17513&st=0&p=346914&>

And, finally, *Leonid's* fanboi thread.

<http://forums.atomicmpc.com.au/index>

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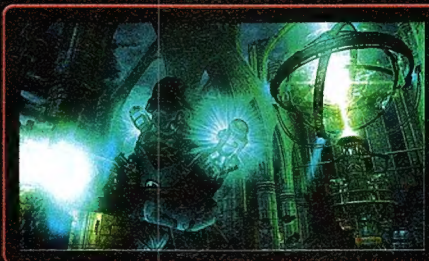
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1. Samsung BD8200

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Down the page, you'll discover Akai's really neat all-in-one AV solution. It is cool, but what if you just want sound and HD vision? What Blu-ray player do you go for, and what new sound system? How about one that does both, like the BD8200?

The BD8200 is both Blu-ray player and soundbar, and combines great image quality (really, you've not seen *Serenity* until you've seen it on Blu-ray!) with great sound from the bar itself and the included wireless subwoofer. If you're looking to fill a small space with sound easy and elegantly, this is about the best solution we've come across.

2. Star Trek USB Communicator

Price \$US39.99 Website www.thinkgeek.com

If there's any sound more iconically geeky – or as cool – as the communicator chirp from the original *Star Trek*, we don't want it is. Hell! We don't want to know what it is! And now, you can combine that chirp with a cool *Trek* toy that actually does what it says on the tin...

The *Star Trek* USB Communicator plugs into your PC via a six foot cable, and acts as a mic or handset for all manner of Uhura-like functions (except fan-dancing): Skype, MSN, AIM, iChat, and so on. It's got a mute function, volume a control, 21 built-in sound effects and is compatible with Windows Vista and XP, as well as those pesky Mac OSes.

But most importantly, you'll earn the respect of your peers when you use this to chat with shipmates when the *Star Trek* MMO eventually comes out. Is there any synergy better than that?

No.

3. Dvico Tvix R-3300 network media player

Price \$399 Website www.alsotech.com.au

Okay, we admit up front – we have no idea how to pronounce the name of this media player. We do, however, admit it might end up being the name of our Jedi when the *Knights of the Old Republic* MMO launches.

We also know that the Dvico Tvix R-3300 can play back HD files in 1080i output, and can decode everything from MPEG1 to Xvid files, as well as DVD backups. It includes an Ethernet port for PC file sharing, supports HDMI 1.1, can double as a timeshifting PVR and it has two USB ports – for thumb drives or an optional wireless dongle.

And it has a digital TV tuner! It's a pretty neat way to catch up to all the latest (more or less) in broadcast technology.

4. Akai All-In-One Home Entertainment Unit

Price \$999.95 Website www.audion-mm.com

It's not good enough that our tech – whether it be a PC or a sound-system – be powerful, it must also look the part. It must look stylish, and that's something that the new Akai All-In-One Home Entertainment Unit has in spades.

Aside from the style-spades, it's also got the practical goods – and it's not lying about that all-in-one bit! It features an iPod dock, built-in amp and speakers with a total 80 Watts RMS, an AM/FM clock radio, and USB functionality for playing media off of one of the no doubt dozens of thumb drives you have (or is that just us?). The All-In-One also has a DVD player that upscales to 1080p.

All that, and it's in a sexy black single unit that can support your television on top.

Now... if I can just get a house where this wouldn't stand out like a sore but sexy thumb, I'd be really happy.

5. My Book World Edition II

Price \$999 Website www.westerndigital.com

We like big backups, and we can't deny... the new My Book from Western Digital offers some pretty big – and saucy – backups.

The My Book World Edition II delivers continuous and automatic backup across all the machines on your network across a dual drive system that uses RAID 1 to mirror data across both drives. Data security for the win!

There's far more to the My Book than good data management, though. It can stream media to any connected PC, media player or DLNA certified game console, provides remote access to data, syncs with iTunes and features a quieter, greener design. And it can swallow down those huge backups via Gigabit Ethernet.

If you have only one backup device in your setup, this is the one to have.





The Babylon Project

Encoding, sci-fi, and the application of geekery?
Sounds like a recipe for another of Ashton's X-Rays.

We live in an age of multi-terabyte hard drives, high-definition 1080p displays, and remarkable compression technologies. And, while dusting my precious (read: the entire five seasons of Babylon 5 – all 110 episodes, seven movies, and the Crusade spinoff), I realised the series is pushing on 15 years now, and while the DVD sets came out a little later, contrary to marketing they won't last forever. And since the chance of a Blu-ray release is somewhere close to Kelvin, I decided now would be a good time preserve them by ripping them to my 1TB media box.

But not just any old rips. As space is not an issue, and HD displays are common now, while settle for mediocre DVD quality? Could I both preserve – and improve – my Babylon 5 collection while also making it easy to play my media box?

The Babylon Project was born!

Weapon of choice

When it comes to encoding there is... a lot to consider. Not just in terms of codecs and containers, but even encoding software itself for which there is a huge range to choose from. Without getting into a discussion to fill another X-Ray, suffice to say for this project I chose to go with the codec de-jour at the moment – h264 – and a cross-platform, open-source, and feature rich encoder: Mencoder. If you've heard of Mplayer under Windows or Linux, Mencoder is simply its encoding counterpart. As it's cross-platform, if you feel a similar need to uberise your favourite DVD collection, you can do so following this project under Windows or Linux.

Mencoder, like many encoders, calls upon libraries for some of the popular codecs, including the open-source implementation of h264 called x264. Even mencoder itself is often called on as a backend for GUI frontends that handle mencoder, ffmpeg or others. And, while a GUI is an option, I'm going commando at the command line for this – not because I'm a Linux nut or sadistic, but because when it comes to executing complex encoding setups – and testing various options extensively as I did – the command line is just easier and quicker.

If you can't bear to look at a prompt, GUIs like MeGUI, StaxRIP, Avidemux will help you follow this X-Ray through a user-friendly

And there are a lot of them. Mencoder's man(ual) page is longer than War and Peace. I know this because I read it. Suffice to say armed with the knowledge therein, I wanted to eke the best possible quality out of the process, and set about comparing de-noising, sharpening, scaling, and post-processing options in addition to a myriad of x264 options over a series of some one hundred encodes. It took a while, but in the end I achieved some excellent results.

If you're along for the ride, you can grab Mencoder and x264 in any decent Linux distribution, or Windows binaries at www.mplayerhq.hu and x264.nl respectively (including 64-bit binaries). If you're along for

... because when it comes to
executing complex encoding setups the
command line is just easier and quicker.

interface, but note not all of them may expose the full feature sets of mencoder and x264 like you'll have access to at the command line.

Mencoder

Ripping aside, the encoding process is two stages: filtering, and encoding. Mencoder can apply filters to clean up, enhance, and improve video while x264 will encode the results into a compact, quality, format. All the options for mencoder, and all the options for x264, can be specified with a single command.

the hardcore ride, you'll want to grab the very latest development snapshots of Mencoder and x264. Under Linux this is reasonably easy – if you're not already using a source-based distro like Arch or Gentoo, see this clear step by step guide to .deb based distros: ubuntuforums.org/showthread.php?t=1081070

The tradeoff

By its very definition encoding is a science of tradeoffs. Even when space (or bandwidth) isn't an issue, you still need to consider quality and

time. It's like the maxim "bug free, cheap, on time – choose two" – for encoding these vectors are quality, size, and time. If you choose maximum quality with a compact file size, it's going to take a lot of time to do. If you want a fast encode, you'll need to lax off on quality, or size.

For the Babylon Project space is not an issue, but I don't reasonably want to be storing 5GB per episode (there are *other* uses for that 1TB!). CPU time is also not a concern, as I'm happy to invest it heavily now at encoding and be done with it. So my choices are maximum quality, reasonable file size, and a slow encode. Which is exactly what I achieved.

Note that when you do this yourself there is a golden rule: beauty is in the eye of the beholder. What looks good to me may not look good to you, so when you're playing with filters and codec options for that quality/space/time trade off, all that matters is that you're happy with the result. There is no one size fits all – not only is quality subjective, but the effectiveness of filters and codecs depends on the source material too. Encoding clean HD material is very different from old TV shows or Anime, for example. So when it comes to options for your own material, test everything first. It's the Atomic thing to do anyway.

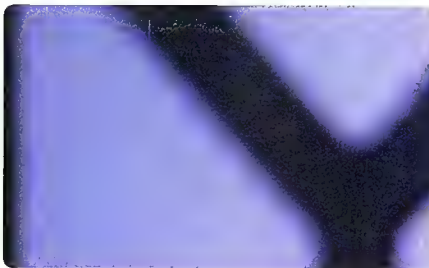
Encoding with Mencoder

After weeks of experimentation, the final options I settled upon for the Babylon Project are below, encoding an episode at a time.

```
mencoder -sws 9 -vf scale=1280:720,hqdn3d=6:5:8,unsharp=17x5:1,pp=ha:128:7/va/dr/al -ovc x264 -x264encopts subq=9:b_pyramid:weight_b:8x8dct:me=umh:cabac:partitions=all:trellis=2:mixed_refs:direct_pred=auto:psy-rd=1.0,0.2:qp=16:threads=2:nodct:decimate:nofast_pskip:bframes=6:frameref=6 -oac copy dvd://1 -o S01E01.avi
```

First, see the split between Mencoder's filter options (everything following '-vf', video filter) and x264's options (everything post '-x264encopts'). The '-oac' flag specifies audio options, and since audio is minimal compared to video, it's best to simply preserve the original tracks as is with 'copy'. Finally, the 'dvd://1' specifies the source device and first track of the media, while '-o' simply states the output filename.

While the ordering of the options for x264 doesn't matter, the sequence of filters for Mencoder does – they are processed in order, and so for example as sharpening can highlight not just details but also 'noise', de-noising before sharpening is a good idea. As space is limited, the following breakdown only scratches the surface of some of the options and how they work. Far more granular configurability delve into the manual ([man mencoder](#)).



The effect of the denoise filter for cleaning up an image.

Scaling

`-sws 9 -vf scale=1280:720`

The DVDs are stored as 720 x 576 and, while once that seemed awesome, it's now a tad dated. I have a HD display, so why not use it? The first filter is to up-scale – from 720x576 to 720p (1280 x 720). Now, while it's true you can't create what isn't there – upscaling isn't going to get you a 'true' HD picture – what it does allow is for all subsequent filters to work with more pixels, which can have an appreciable effect on the final result.

For Mencoder there are ten different scalers on offer. Most are optimised to produce good quality when *shrinking* resolution, but don't always do so well when it comes to approximating missing information as is the case with upscaling. The long story short here is to use options nine or ten, lanczos or bicubic spline.

You may already recognise lanczos as an upscaler in graphics manipulation tools. In simplest terms, lanczos works by interpolating pixels in proportion from the original scale to the new one, and performs better than algorithms that simply linearly calculate a new size.

Note both the X and Y aspects are forced in my selection, as the Babylon 5 DVDs are widescreen. If your source is 4:3, you can specify one aspect or the other to resize while maintaining aspect ratio.

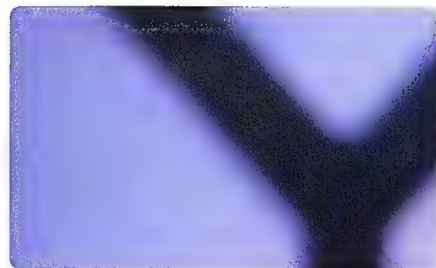
Finally, keep in mind scaling has a big impact on file size. Re-sizing the DVD episodes from 720 x 576 to 1280 x 720 is more than doubling the number of pixels from 414,720 to 921,600, and all things being equal with the encoder, you can expect the final file to be equally as large.

Denoise

`hqdn3d=6:5:8`

Noise is the grain you sometimes see, especially on older movies and shows. The human eye tends to prefer a cleaner image, and so the Mencoder manual actually recommends a light denoising (2:1:2) even for high-quality sources. My Babylon 5 DVDs, unfortunately, don't fit into that category. In fact, they are quite noisy even by DVD standards. Again while there are a few to choose from, the recommended denoising filter is `hqdn3d`, aka the high precision denoise3d filter. It works by identifying intensities in pixels and averaging them out compared to their neighbours, resulting in 'smoother' images. There is however a fine line between removing noise and removing detail, so as with any other filter there are options to control intensity.

The default values for hqdn3d are 4:3:6 for the



luma spatial, chroma spatial, and luma temporal strength (temporal takes into account adjacent frames between images). They work well for most sources, but on the Babylon 5 DVDs, after some experimentation, I opted for a stronger effect using 6:5:8.

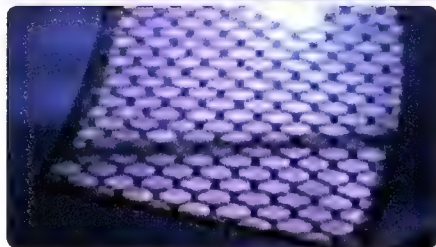
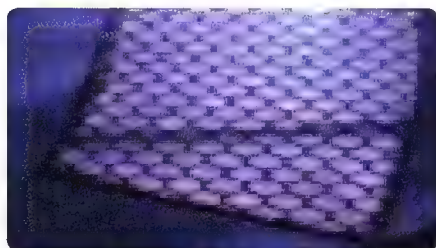
Note that noise is heavy. Denoising can not only clean up an image, but make it more compressible too (conformity among the pixels means the images will compress better). Denoising is hence usually recommended as it can both improve image quality and help produce smaller files. How much smaller? By way of example the difference between standard hqdn3d defaults and my tweaks on just 30s of encoding was around 15MB in file size. Extrapolate that out to an entire 45 minute episode and that's an extra 1.3GB!

Sharpening

`unsharp=17x5:1`

Sharpening is a special type of filter that helps highlight edges. It does this by first creating a Gaussian blur of the image and then subtracting the difference between it and the original, producing an image with details that appear to stand out.

With Mencoder, the filter can both blur and sharpen on luma and chroma. Generally a range of 0-1.5 will provide good results, and you don't usually need to bother with applying to chroma; in fact you might get better results if you don't.



Close up on a floor panel in the Babylon 5 station. DVD source compared to the scaled and sharpened equivalent.

In addition to sharpening strength you can define the grid size that will help determine what encapsulates an edge. The default is 3 x 3, but you may get better results with a larger grid. Not being a video guru, I took advice for expanding this to 7 x 5 with a moderate strength of 1. The result for the Babylon 5 DVDs was excellent, bringing out fine details like hair and patterns on uniforms that, literally, were barely noticeable in the original DVD source.

Keep in mind that too much sharpening can also highlight artifacts in an image, as well cause a ringing effect. Deringing can help mitigate this, but again it's a matter of finding a balance that requires testing values and choosing what looks good to you.

Post processing

`pp=ha:128:7/va/dr/al`

Post processing encapsulates a range of options that include deblocking (smoothing out 'blocky' edges due to encoding), deringing (reduce the 'ghosting' effect around edges) and brightness/contrast correction. The 'pp' filter in Mencoder is highly configurable, and here the recommended setting of high quality, with the addition of the 'al' autolevel option to bring out contrast, worked best. Generally, post processing is the last filter in the chain, and just helps clean up the final picture. It's not always necessary though, especially with good quality sources. Try with and without and see.

Other options

Depending on your source, you may like to automatically crop the image and make better use of both screen real-estate or your rescaling. Mencoder can recommend cropping size by scanning the source first with the 'cropdetect' option.

If your source is interlaced, you'll most likely want to deinterlace it. You can recognise interlaced sources, especially with motion on



Ivanova from DVD source and encode. Note details like her eye lashes are blurred on the DVD, but clear on the encoded version.

sizes, as it helps the encoder make best usage of available bits when bitrate limits are imposed. Running multipass is as simple as appending

maximum quality while maintaining a good compression ratio. If you're using these options as a base, you can squeeze a smaller file size by reducing the quantizer quality parameter ('qp=', 26 is default, approaching 0 produces lossless). The 'threads' option allows you to maximise encoding time by running at least one thread per core. Encoding on a Core2Duo E8600 @ 4.5GHz took about four hours an episode. If you have a quad core, you can finally put it to good use!

...if you apply deinterlacing to a progressive source, detail will be lost as frames are blended.

screen, as split lines where the original frame was split into two fields. There are, again, lots of deinterlacing options in Mencoder, and one of the most effective is 'yadif'. If you need to use it, just prepend it to your -vf filter chain – it should be the first filter, you want to deinterlace before you do anything else (especially scaling).

Note that if you apply deinterlacing to a progressive source, detail will be lost as frames are blended. And this is precisely what happened with the Babylon 5 episodes: while the core of the show is progressive, the CGI sequences (perhaps as because they were originally intended for NTSC broadcast) are interlaced. I decided against deinterlacing in the end, as the CGI sequences aren't the core of the show.

Finally, doing 2-pass encoding is recommended if you're trying to maximise quality in small file

`turbo:pass=1` to the end of the x264 opts for the first pass, replacing this with `:pass=2` for the second pass.

x264

The x264 options are equally important if you're trying to maximise quality for a set bitrate. Given I was more than doubling the pixels, I was happy to go with a result that might be double the original 1GB VOB files per episode, which is not a bad goal, especially when you consider the resulting video is sharper and contains more 'detail'. And this is what I achieved, with around 2.2GB per episode.

There isn't space to go into all the x264 options here (again refer to the manual) but suffice to say the above command uses most of the options that aren't already default for

Would Zathras be proud?

Oh yes. In terms of quality the Babylon 5 encodes are greatly improved in playback compared to the DVDs. In a direct comparison of the same episode through the the Blu-ray player, which touts its ability to upscale DVDs, there's simply no competition – the encodes are clearer, more detailed, and sharper. Not only have I preserved my precious collection, but I've given it a renewed lease as well!

I feel a Babylon 5 marathon coming on. I wonder if there's anyone out there I haven't yet roped into watching the best sci-fi show of all time...

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Innovation leader

Over the past two decades, ASUS has believed in the mantra of **"Design Matters"** and takes pride in the development of good motherboard designs. As the company continues to develop innovations that raise the industry standard, we look at the stories behind the research and development engineers' hard work.

ASUS sets the benchmark with the revolutionary Xtreme phase power design

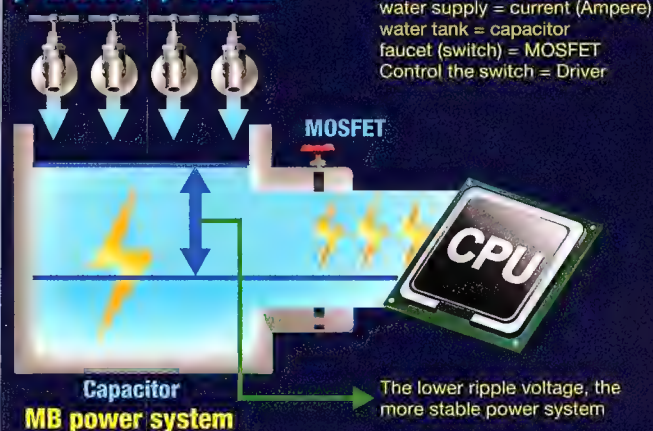
The perpetual quest for more power

The designs of motherboard power supply systems have become more crucial since the rise in popularity of overclocking and the increased power consumption of CPUs ever since the advent of the Pentium4.

The theory behind Power Phase Design

To get a better understanding of phase power design, we'll use a faucet to illustrate the point. When water supply exceeds that of demand, we can simply switch it off or decrease the rate of water flow. When the demand exceeds that of supply, we can turn the switch to increase the rate of water flow.

POWER PHASE



A good power phase design allows phases to operate smoothly and provides the lowest ripple voltage power supply to CPU

ASUS Xtreme Phase Power Design is a delicately designed power supply system that comprises of a driver, MOSFETs, a capacitor, and a choke.

It automatically regulates current and voltage to deliver maximum power efficiency under any loading. It results in a better thermal solution, and helps prolong the lifespan of the motherboard and various components.

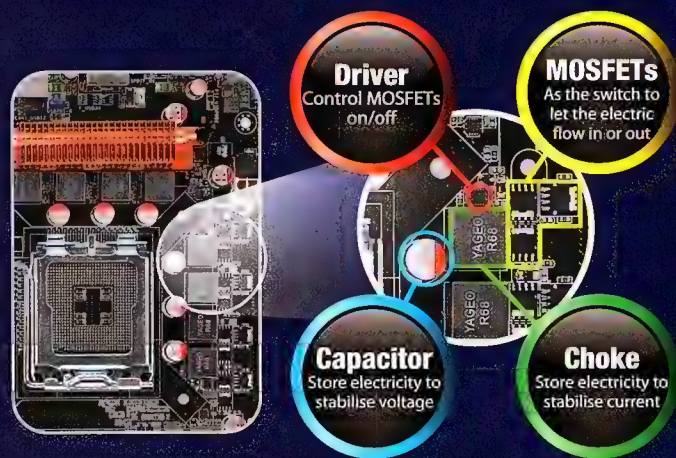
ASUS was the first to invent the 8-phase power design. Multi-phase designs are more sensitive to power requirements and stabilises the power supply by minimising voltage fluctuations.

ASUS - A leader in Power Phase development

To cater to the overclocking community, ASUS introduced the P45 and X58 motherboards—the first motherboards with 16-phase power design.

Others in the market have tried to follow in ASUS' footsteps by launching their own multi-phase designs, but ASUS' Xtreme Phase design remains the industry benchmark that guarantees superior performance and system stability.

1 set true phase power = Driver + MOSFETs + Choke + Capacitor



INPUTOUTPUT

Dan Rutter brings the answers to your questions like no-one else can.

I/O OF THE MONTH Poisonous cards

I I've been busy, and so has my boss. Long story short, he was beta-testing a product and got a comp'd trip to Vegas to see Winter CES and the adult video awards (gives you an idea of the sort of product it is – an IP-TV box for porn).

I spotted him the cash for the flight, and he came back with enough scratch to get a new PC, and left me with the old one to cover the trip... and then the thing failed catastrophically, with an apparently completely dead motherboard.

I have the cards, the RAM, the processor, the removable-media drives and the presumably dead mainboard; he got the fixed disks back in drive boxes to recover his data. I installed them in the boxes, and they were fine.

What I want to know is, can these components carry some damage from whatever caused the mysterious fault in the machine, that can in turn damage whatever machine they are put into? I understand there is always some risk of this with any hardware, but is this risk significant enough that I should avoid putting the cards into my main machine?

There are two cards. One's a huge ATI Radeon X850 XT PE 256M, which I presume refers to its available memory (I have an Nvidia GeForce 8500 GT with half a gig... is one of these cards clearly the other's better?). The other card is an Indonesian TV tuner, called a Hauppauge WinTV HVR-1600, both ATSC and NTSC compatible. The RAM is DDR2, I believe. The processor is I think a dual-core, and if it is it might have a place in a new system when I get 'round to building one, assuming it too survived.

Sean Meskill

O Yes, the components may be damaged. And it won't necessarily be obvious.

There's a surprisingly wide grey area between 'A-OK' and 'completely dead' for a lot of computer hardware, especially if it's been handled without proper electrostatic discharge precautions.

Mechanical damage to hardware is also possible. If power-supply smoothing caps

have been knocked off a board or have dried out, for instance, then you can end up with a card that's fine in one computer (with a strong PSU) but flaky in another (with a weak PSU).

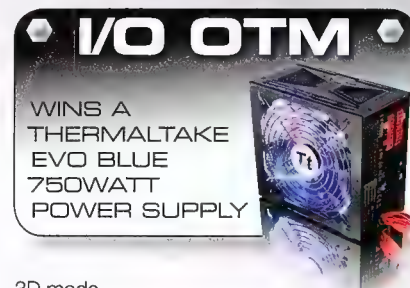
It's also possible, but not likely, that the cards will damage a computer you put them in. I think the only remotely probable way in which this can happen is if a card's got a short from a power pin to ground, or possibly to something that's not ground but will still make Bad Things happen if +12V suddenly appears on it.

The usual way in which people manage to do this sort of thing isn't by plugging damaged cards into a slot, though – it's by jamming cards or memory modules into the wrong slot entirely, or into the right slot backward. Not everybody twigs to the fact that it's not right if a component can only be 'installed' with the help of a rubber mallet.

There's also the 'mechanical virus' situation, in which a damaged socket damages the cable you plug into it, which will then damage the next socket you try to plug it into, which will then damage any future plugs, et cetera. That ought to only happen with pin connectors, but some genius has probably found a way to do it to an edge connector as well.

I wouldn't be worried about putting pretty much any component from a dead computer into a new computer, though, even if I wasn't quite sure if that component still worked. This obviously doesn't apply if the component was emitting smoke and/or flame the last time you saw it powered up, but if it looks okay, I wouldn't be frightened about trying it.

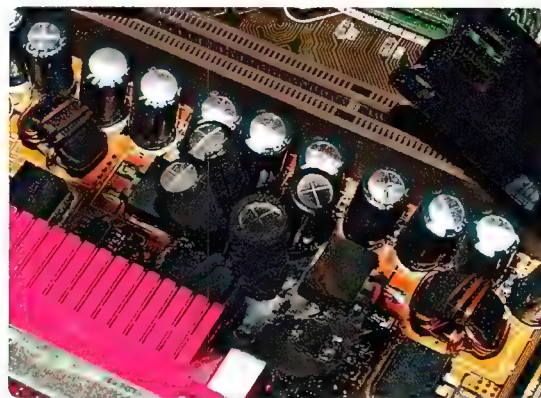
Your hefty Radeon X850 card was a high-end product in 2005, competing against the 6000-series GeForces (and losing, but not by miles). Your GeForce 8500 is a couple of years younger than the X850, but was cut down to 6000-series-like specs. So it depends on the game, but the 8500 should be significantly, but not amazingly, faster for most tests. Plus it's got a useful amount of extra memory and should consume, oh, maybe 50 watts less power in



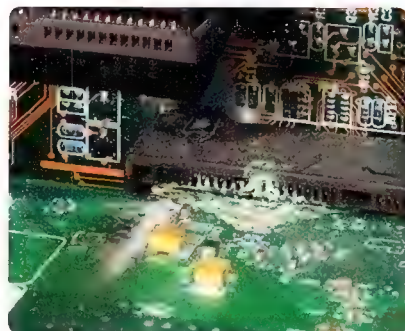
3D mode.

The TV tuner card, in contrast, is definitely still a useful product, if you actually have the appropriate kinds of TV available where you live. I think it'd be perfectly useless to anyone here in Australia.

The DDR2 RAM is probably fine, too. It's no big deal if it turns out to be flaky or dead, though, since DDR2 has been almost free for some time, now. ☹



The CPU from this computer...



...did this to the graphics card of another computer!

Blackout hunting

I One of the computer rooms at our school is suffering intermittent power outages. That is, occasionally the circuit breaker trips. There's no obvious reason for it so I'm starting at stage 1 – determining what pattern exists, if any. To do that I need to find some way to log when the power goes off and back on again. The commercial systems available to do this are well above our (my) small budget.

One thought I had was to look into using a laptop and logging the change from AC to battery power. Another thought was to get an old UPS (APC Smart-UPS 1400) and to use it in conjunction with its monitoring app. However I don't have any laptops that have a serial port, and monitoring the UPS with a desktop PC may run afoul of the whole power problem we're trying to trace (the UPS batteries are pretty well useless).

Do you have any elegant (and low cost) suggestions?

Paul Pofandt

O As you have already discovered, there are many ways to do this by spending lots of money. Dedicated hardware power monitors, alarm panels, et cetera. Old-UPS-via-serial would be doable on modern hardware as long as the software worked with one of those cheap USB-to-serial doodads. You could also replace the UPS batteries quite inexpensively, with a little hacking (www.dansdata.com/upsupgrade.htm).

After I'd thought about this for a bit, though, I realised there's an easier way. Well, there is if you don't mind connecting a few \$5 eBay items together.

There's a plugpack in a wall socket, see, on the circuit that keeps losing power. The output of that plugpack goes to a normally-open ('off') relay, which the plugpack voltage is holding closed ('on'). A relay is an electrically-actuated switch, the predecessor of the valve and transistor; it can switch a high-powered load on or off, when you feed a small amount of power to its separate coil contacts.

This relay is not being used to switch a large load, though. Instead, it's passing power from a AA battery, to run a cheap wall clock set to the correct time. When the power fails, the relay clicks open, and the clock stops. Voila! And no mains-voltage wiring needed, either.

You can make more capable versions of this idea, to for instance deal with power that goes out and then comes back again, by incorporating a 'latching' relay, which stays in whatever state you've switched it to with one set of coil contacts until you energise another set. Or you could use a standard relay to allow power to flow from an old Lego battery pack to an old Lego motor, which turns a winch which physically yanks the AA battery out of the back of the same cheap wall clock.

You could set up a system much more capable than this with Lego Mindstorms gear, but again, that's not cheap. Lots of people, in contrast, have a bunch of random Lego including a motor or two, and you can do some quite sophisticated things with simple motors, mechanical linkages and very inexpensive electronics.

Plus, you can't help but feel studly when you solve a real-world problem with Lego.

A hunka hunka burnin' drive

I I've heard that some organisations, like the military, use thermite to destroy disk drives that contain secret information.

I know thermite burns really hot, but is it actually hot enough to destroy everything in a modern hard drive? Could some bit of the disk survive, and be theoretically readable?

Steven Stafford

O If you don't use enough thermite, then yes, bits of platter could survive and be, at least in theory, legible.

If you cover a whole drive with a layer of thermite only a couple of centimetres thick, though, 'toast' is an inadequate word for what that drive is going to be.

Standard iron-oxide/aluminium thermite burns at around 2,500°C. The stream of molten metal it creates is cooler, but not by a lot. These are high enough temperatures that you're no longer looking up the melting points of common substances, but instead checking their boiling points, in case they flash to vapour and cause an explosion.

The chassis and platters of most hard drives are made of aluminium alloys, whose boiling point is likely to be only slightly above the burning temperature of standard thermite. More and more drives now have glass platters; different glass formulations have different melting points – plain soda-lime window glass has the soda and lime additives specifically to reduce its melting point – but thermite, once again, burns hotter than the boiling point of even pure silicon dioxide ('fused quartz').

The fibreglass, solder, epoxy and plastic components of a drive will of course be obliterated even faster. Any copper wiring, though, may get close to boiling point, but not quite there.

Some of the components of the actual coating on the platters won't even melt – there's likely to be carbon in there, for instance, and that melts at 3,527°C – but the coating will be all mushed up with the boiled and bubbled other parts of the drive, and very conclusively thermally demagnetised.

(Magnetic materials are demagnetised if you heat them above their 'Curie temperature'. For hard-drive coatings, that temperature is likely to be below 1,000°C, and definitely far below 2,000°C.)

Ceramic drive platters may not melt, but thermal shock will shatter them into little bits, and their magnetic coating will be just as annihilated as would the coating on a metal platter. ☺



If it can weld train tracks, it can probably kill a hard drive.



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The itch



Nostalgia? It was much better in Ashton Mills' day.

I remember how I got into all this. It started with my first computer, handed down from my dad. An Olivetti, and I loved it. It played all the DOS games but it wasn't long before it started showing its age. I needed a new PC, and that's when a friend of mine said something I hadn't considered before: why don't you build one?

"Build one? Isn't that, like, hard?" He laughed, "No! Well, not if you don't muck up the power connectors."

I considered his words because money was tight and building from parts was cheaper. So I asked for a list of what I needed, and off I went.

386DX 33MHz, 32M RAM, motherboard, power supply. I would transfer the drive from the Olivetti across. Oh, and video card – and this is where I first got the itch. At the shop I asked for a video card, and the guy handed me a Trident. Back at home, I called my friend.

my blood." Hrgh, I grunted, "War scars, we all get 'em".

I digress. Back to the video card.

"So what did you get?" he asked. "A Trident" I replied. "What? Should have got a Tseng ET4000!" he retorted. "There's a difference?"

Ah, the innocence of youth. He proceeded to tell me the Tseng was the card to have, because its VESA implementation is copied from the BIOS to system RAM at bootup, accelerating any VESA based games. I felt a pang, that pang of missing performance. Next time, I vowed.

And there was, some months later. I ditched the Trident and bought the Tseng. It was faster, much faster. This was awesome. What else could I improve? The itch grew, and a year later I was on my third machine proudly sporting what I called the 3-M. It had the latest video card with 1MB onboard. One whole meg! The soundcard

pre-emptive multitasking tool back before Windows was even released. Developed by Quarterdeck, the company also made QEMM – the extended memory manager that exploited a bug in Intel's x86 design, and that ultimately sped the development of games by giving them access to high memory. It was even included with DOOM. The taste for multitasking didn't end there though, OS/2 was the next step, and when IBM stopped supporting it I found Linux. It was the tweaking, building, hacker mentality made manifest.

We've come a long way. Whoever thought computer gear could be so diverse? That's how a lot of the world still thinks – a hard drive is a hard drive, a video card a video card. We know differently, we have that itch for the best performance, best operating system, best tweaks and mods...

As far as itches go, it's a great one to have :) 

...I used to bounce it off the bed like a basketball to get the bearings moving...

"So, uh, what was that about power?"

"Red to pin 1", he said, "Or you'll fry stuff". We have it easy today, plugs only go in one way. Back then you had to find the positive wire with a red stripe, and line it up with pin 1. Or lose the part.

"Right got it... what about the PSU?"

"Make sure you hook up the switch correctly or else..." I interrupted, "Yeah, I know". There was no switching via the motherboard like now, you had to hook the PSU to a switch – something I later foolishly did once while it was plugged in. I got my first scar that day, an electrical burn in the shape of a pin, and one heck of a scary shock.

But then, pain was par for the course for builders. Fiddly plugs, sharp cases, and more. I remember guiding one friend over the phone to install his new RAM. It was hard for a while, tight spaces and clips, and then it just slipped it in easy. "What changed?" I asked. "I don't know!" he said, and then a pause. He was looking at his hands. "Oh... I got cut, it was lubricated by

elite at the time, the humble GUS – Gravis Ultrasound, also with 1MB onboard. And then there was a special ATA controller with its own 1MB onboard cache. At soft-boot, DOS loaded instantly from the cache, generating drools from my friends.

When my ageing hard drive would refuse to boot, I used to bounce it off the bed like a basketball to get the bearings moving, plug it in, and use it for another week before the next freeze.

Wild days.

But I wanted more. I had read about RAID and though no consumer RAID cards existed, nor anything remotely like an onboard RAID, I found a way – a special mobo BIOS called MrBIOS that would set up striped drives to appear as a single drive. And it worked marvellously. I used to watch the LEDs on a pair of Seagates flicker in tandem as I loaded games.

The itch grew. When I was happy with the hardware I turned to software. I would multi-task DOS with Desqview/X, an incredible

Yes, Ashton Mills has no gum.

He has, no gum, tonight.

amills@atomicmpc.com.au

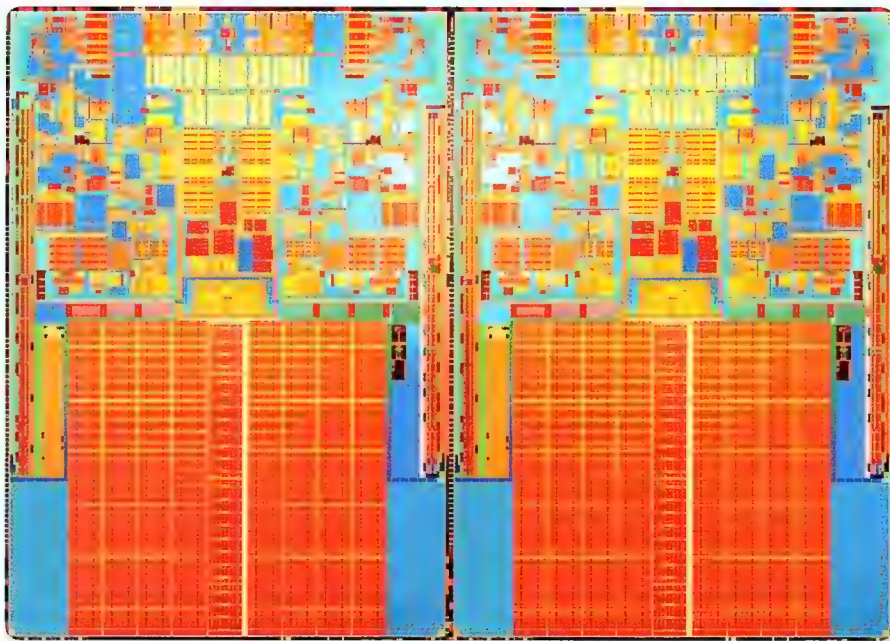




Parallel Ports

As the cost of developing games has risen, so has the popularity of releasing titles across multiple platforms. While making the same game for the Xbox 360, PS3, Wii and PC is attractive for publishers, PC gamers often feel hard done by when it comes to 'ported' games. **Ben Hardwidge** talks to developers about the difficulties involved.

You don't need to be a 1970s stand-up comedian to know that there's a large lexicon of monosyllabic, four-letter words for describing something you don't like – but only PC gamers use the word 'port' with such a fervent degree of repulsion. Common complaints about console ports include meagre graphics options, dodgy third-person camera angles, poorly thought-out controls and sparsely distributed save points. Making games for multiple platforms can't be easy though. After all, each current gaming platform has radically different processor architecture, as well as completely different controllers and graphics APIs. That's before you've even considered storage, memory and online abilities. Just how do you develop a game for so many different types of hardware, and is it possible to make a great game across three consoles and the PC?



The PS3's Cell CPU has a different internal architecture from a 45nm Core 2 Quad CPU (pictured), but getting a game to work on both CPUs is now just a job for a recompiler.

Different CPU architectures

Let's start with the different CPU architectures. PCs use CPUs with Intel's x86 instruction set, the Xbox 360 and Wii use CPUs based on IBM's PowerPC architecture, and the PlayStation 3 uses the Cell architecture. You'd think that generating code for each CPU would be a job for master coders, but there's apparently little work involved here.

This is because a huge chunk of the code for a game is written using a high-level language, such as C or C++. This is where the core code for the actual game is written, often using a number of industry-standard tools, such as Microsoft's Visual Studio, or specifically developed in-house tools. A particularly popular language is Lua, which has a C API and is used by plenty of developers, including Bioware, LucasArts and Telltale.

In fact, the developers we spoke to estimated that around 90 per cent of the game code is shared between platforms, so what sort of game features are included in this huge block of code? Volition's Dave Baranec, the system architect on the PC version of *Red Faction: Guerrilla*, explains that this includes "the key libraries for rendering, audio, file system and memory management. Any sane development process involves creating these libraries in such a way that there is a common abstract interface that can have the details filled in later".

Once the basic code is written, it goes through an automated process of recompiling, which is often created in-house by a developer as a part of its tools pipeline, in order to make it run on other processor architectures.

In this case, compiling refers to the process of transforming high-level source code into

low-level code that can be understood by the processor.

After that, there's usually a bit of tweaking in machine code (the native language of the processor architecture) or assembly code (a low-level, symbolic representation of numeric machine code), but this apparently occurs less frequently now.

"It's all done in C++," explains Visceral's Colin 'Bozz' Boswell, technical director on *Dead Space*, adding that "we do write a very small amount of assembly code. Very occasionally, we'll go in and do spot optimisations on functions that are used a hell of a lot in the game, but we try not to do that because the compilers are pretty good at optimising now, and sometimes you can actually make matters worse by doing [it yourself]".

As the game is written in C++ for all platforms, Bozz says that "the actual porting of code is generally just a matter of recompile. We've been doing this long enough to have developed a set of macros and header files that abstract-out all the other specific differences. So, from a pure source code point of view, you'll occasionally get the odd warning or error on one compiler that you don't get on another, but that's very low".

Telltale Games' co-founder Kevin Bruner describes a similar process for porting Telltale's recent episodic adventure games *Sam & Max*, *Strong Bad* and *Wallace & Gromit* from the PC to the Wii and the Xbox 360.

"Most of our code is written in C," says Bruner, but adds, "We still have a machine code here and there. For those parts, we have [both] an x86 version and a PowerPC version." However, the recompiling process is now so efficient that it's not a major issue.

That said, even though the bulk of the

code is shared, developers often have to hop between different tools for different platforms. "Any developer who is being honest will tell you that these days the act of writing engine level code for a game is the act of being a glorified data wrangler," says Baranec.

"Taking source data, piping it through a complex series of source control, data processing and messaging tools, arranging it on disk, loading it at the right time and handing it out to completely different pieces of hardware, and then being able to test it is a really difficult dance. Ideally, you would write the code to do this once, but the reality is that each system has certain ways of operating, and unique tools provided by the manufacturers to enable this, so you end up having to modify your workflow for the different platforms."

"In the grand scheme of things," says Baranec, "the actual CPU differences don't have nearly as much of an impact as the higher level architectural differences – particularly when it comes to multiprocessing."

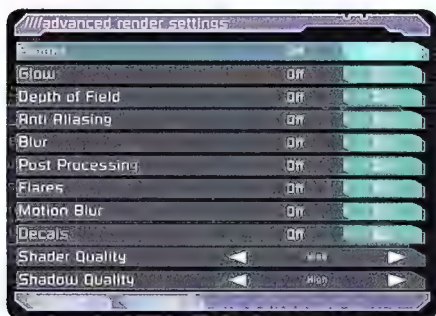
He has a point. After all, you have a single 729MHz PowerPC chip on the Wii, a 3.2GHz triple-core PowerPC chip on the Xbox 360, a central processing core with seven SPUs on the PS3, and then you have one to four x86 cores on most PCs.

Not only that, but each system also handles multithreading in a slightly different way. For a start, some PC CPUs have HyperThreading, while others don't. To further complicate matters, Baranec points out that "on the Xbox 360 you have three cores and six hardware threads, all of which can access all available RAM. On the PS3 you have one core and two hardware threads that can access main RAM, and seven SPUs that can only access a local store of 256KB at a time". He also points out that the PS3's SPUs can also "be used in a way as to make them coprocessor-like for the GPU, further muddying the waters".

This complicates matters when you're developing for all CPUs at the same time, and Bozz says that you have to "try to design games to a somewhat abstract processor design". The trick is to work out the precise algorithmic work that you need to do on the CPU and then figure out how to do that best on each type of CPU. "Even though you might be dealing with multiple cores on a PC and SPUs on a PS3, the fundamental algorithms don't change that much; it's just that the implementation details might be different," says Bozz.

At Visceral, the developer of *Dead Space*, this is a job for specific 'domain experts' rather than the core game developers – these are the people who know the processor of each platform inside out and can work out how best to implement the algorithmic content of the game on each CPU. "It's a hard job," says Bozz, "but not impossible."

Sometimes, however, the way in which the CPU works is so fundamentally different from platform to platform that developers end up having to shift work from the CPU to the GPU,



It's easy to put advanced graphics options into the PC version of a multi-platform game such as *Dead Space*, as many of these tweaks are in the developer's debug menu.

and vice versa. "The way you actually get the character skinning information onto the GPU differs from platform to platform," explains Bozz. "The basic algorithmic principle is the same, but the actual implementation details can be very different. Sometimes we'll do some of the skinning on the CPU and some on the GPU, sometimes we'll do it all on the GPU and sometimes we'll do it all on the CPU."

Different GPU architectures

There's also a big difference between the GPUs on each platform. When it comes to the PC and Xbox 360, Telltale uses Nvidia's FX Composer tool to write the shaders for its games, using high-level shader languages such as HLSL for DirectX, and GLSL for OpenGL. As with the CPU code, the graphics code is then run through a readily available shader compiler that creates shader code for the target platform. There's apparently no easy way of doing this between the PC and the Wii, however. "The Wii is still hand-coded," says Bruner, "we'd have to write our own shader compiler at that point, so instead we just write the shaders again."

Telltale's games still use exactly the same textures on each platform though. "We keep the original TGAs [the texture files]," says Bruner, "so we'll take the TGAs and turn them into DXT versions of the textures if we're going to Windows or Xbox, or we'll run them through the Wii texture conversion and turn it into the Wii texture format if it's going to the Wii."

Although Telltale still hand-codes shaders for the Wii, Telltale has developed its own in-house automation tool to help speed up the process of porting games to specific platforms. "You basically describe the beginning resolution," says Bruner. "On a PC that's generally 1,024 x 768 and on the Wii, it's 640 x 480. After that it just follows a bunch of rules for remapping data, using different types of data, bump maps and so on, for each platform, based on our own experience of what works."

Bruner describes the automation process as "relatively aggressive", as the Wii has comparatively limited resources. The end result is a game that will definitely run on the Wii, but with headroom for further hand-tweaking.

Telltale's next task is to delve into the code and tweak parts of it that can be improved without killing performance. "We typically go in for critical shots, or elements that are really important for the critical path of the game," says Bruner. "We'll start dialling up the settings in certain areas, such as the user interface – that's something that you want to look good on the target platform."

The situation appears to be a bit simpler when going between the PC, the PlayStation 3 and the Xbox 360. In *Dead Space*, Bozz likens the process to that of translating code for different CPU architectures. Again, more complicated aspects are handed over to domain experts who really know the graphics architecture on each platform, but Bozz points out that on each platform, you're still performing the same task, but in a different way. "You're always creating a bunch of vertices, you're assigning materials and you're rendering those on the screen," explains Bozz.

"At the core level, you're always doing the same thing, so we do have some abstraction for different APIs, and a small amount of code that might be unique on each platform that will do the low-level interface work."

Graphics settings

As multi-platform games are usually developed primarily for a console, you might think that this would make it harder to include advanced graphics options in the menu of the PC version, but *Dead Space* has settings for Shader Quality, Shadows and post-processing effects. Is it hard to have these sorts of options in the PC version?

Apparently not. *Dead Space*'s producer, Chuck Beaver, explained that the developers need access to all of those controls in the debug menu anyway, as they need to be able to tweak the game's graphics optimally for each platform. As such, the advanced graphics menus are just a user-friendly front end for the debug controls used by the developers.

The bigger issue with

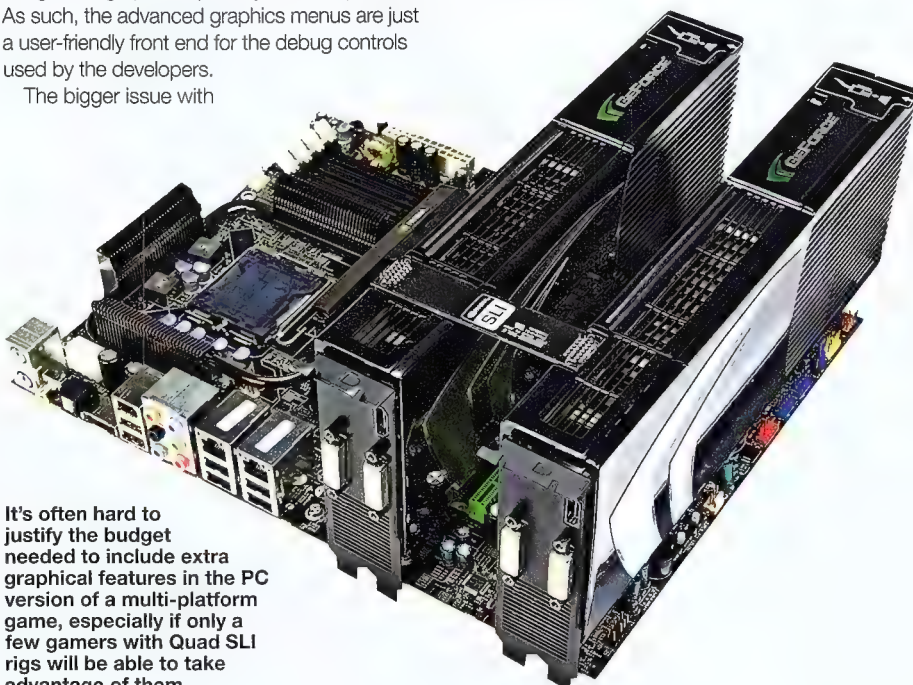
graphics settings on the PC is deciding which settings to expose to gamers. You not only need the game to look good on high-spec PCs, but you also need to decide how far you're willing to sacrifice your game's appearance on low-spec PCs.

For a multi-platform game to work well on all systems, these decisions have to be made early on in the development process. Each system has its own quirks and flaws, and you need to allow for these when developing the game. Beaver offers the example of the PS3. "The PS3 doesn't have a great fill rate, so you can't fill up the screen with v-effects, whereas the Xbox 360 can handle that. You have to design the core game with the PS3 in mind in that case, and then if the Xbox 360 is weak in another area then you have to design to that," he explains.

Are there any areas where the PC is weak? "Generally not," says Beaver, "because there's no actual spec." Consoles have the distinct advantage of a fixed architecture. Developers know the exact specification of each console when they start programming the game, and they also know what the exact specification of the console will be in the years to come.

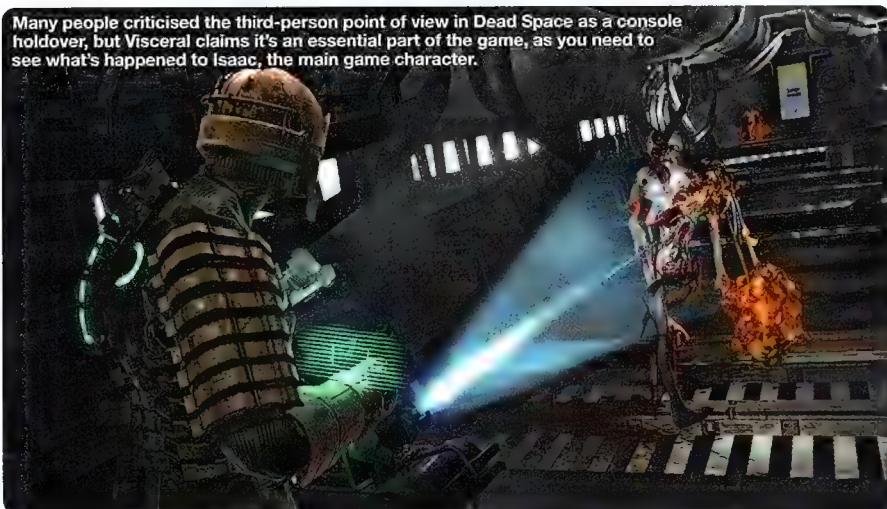
Conversely, with the PC, you have to not only cover various specifications, but also predict what specifications people will be using at the point that your game is released. "That's really the biggest challenge with the PC," says Bozz. "It's very difficult to cover all of the options that consumers have."

According to Bozz, the team at Visceral will compile a 'must-have' list, a 'would-like-to-have' list and a 'would-be-great-but-we-don't-think-we-can-have' list of features they want to put into the game. "Once you've drawn up your lists," says Bozz, "you can start looking at CPU



It's often hard to justify the budget needed to include extra graphical features in the PC version of a multi-platform game, especially if only a few gamers with Quad SLI rigs will be able to take advantage of them.

Many people criticised the third-person point of view in *Dead Space* as a console holdover, but Visceral claims it's an essential part of the game, as you need to see what's happened to Isaac, the main game character.



performance, how much RAM you need and so on, and evaluate every feature based on those criteria. So you can say one feature will need five per cent of a single-core CPU's resources, and five per cent of a good GPU's resources, and once we've done that we prioritise that list based on what we feel is the best experience for the user."

The user experience is key here, as a decent multi-platform game has to be consistently good-looking and playable on every platform, whatever sacrifices have been made. "One of the problems that we run into with lower-end PCs is that we could certainly have the game run on them, but it's not going to be a good user experience," points out Bozz. "We're very concerned about making sure that users have a consistent experience across any platform, be it a PS3, 360 or PC. That's difficult, because it dictates your market – you have to come up with a minimum spec and that's all you can work with."

The same also goes for high-end PC hardware, and developers have to strike a balance between how good they want a game to look, and how many people will be able to run the game at the best settings. Budget restrictions also come into play here, particularly when it comes to adding support for hardware-specific features such as GPU PhysX acceleration, or even multi-GPU support.

That said, implementing multi-GPU support is apparently a pretty simple job in games. "It's generally invisible to us," says Bozz, "and the way that Nvidia and ATI implement their APIs makes it pretty easy for us to do stuff like that." However, it becomes more complicated when you add more than two GPUs, because you're going into territory where only a handful of people will have the hardware. "We have to consider how many users out there have that kind of capability," says Bozz, "I'd love to make a Quad SLI version of *Dead Space*, but how many extra units would I sell?"

The problem for multi-platform game developers making PC games is that at some point you have to say 'stop' when it comes to

extra hardware features. You can always add higher-resolution options in the PC game, but you begin to upset the guys in control of the game's budget if you start putting serious man hours into developing graphics features that are only available to a small number of PC gamers, let alone console gamers. "I know people are going to read this and say, god that guy's telling us that we've bought all this hardware for nothing," says Bozz, "but the reality is that as much as I'd like to support this stuff, I can't do that at the expense of the other 98 per cent of gamers."

A very common bugbear for PC gamers is that they feel that the graphics in a PC version of a game have been compromised, simply because the consoles wouldn't be able to handle the same level of graphics. However, Red Faction: Guerilla's system architect Dave

points out that "consoles are tremendously easier to test for than the PC because of the nature of fixed hardware. Most developers and publishers have entirely separate compatibility departments exclusively used for working with all the weird combinations of PC parts".

According to Bozz, it takes around six engineers a couple of months to test the game on various possible PC configurations, and that's assuming that this is the only work they're doing. Not only that, but the testing has to be done continually throughout the development process. At Visceral, this means testing early on in the cycle when you're trying to gauge the core specs, then again at the Alpha stage and again at the Beta stage, as well as the crucial testing of the final game.

This is part of the reason why PC versions of games often come out a few months after the console versions – although it isn't the only reason. After all, the core game and code is only one part of the equation. You also have to consider the whole user interface and control system, as well as the save game system, and these work very differently on a PC.

Visceral chose a slightly unusual strategy when it came to developing *Dead Space* for multiple platforms. The guys wanted to release the PC version at the same time as the console versions, which meant that they couldn't just develop the game for one platform and then port the code over, as that would add several months to the PC version's development cycle. Instead, Visceral shared a huge chunk of the game code between the platforms, but distributed the rest of the workload to different teams for each platform. For the PC version, the extra coding was handled by another group in Melbourne, so that

"... the situation could certainly be reversed – you could build a game that caters to the strengths of PCs, and find huge problems..."

Baranec disputes this, and says that in fact "we usually find it's the opposite".

Part of the problem is that multi-platform games are usually developed primarily for consoles, which means that they're heavily optimised for those architectures. Baranec explains that "content targets, system design and overall structure tend to be tailored towards what the consoles do best. It isn't uncommon to find that even high-end PCs have a hard time holding up against the sorts of deep optimisations you can make on fixed hardware." However, he also concedes that "the situation could certainly be reversed – you could build a game that caters to the strengths of PCs, and find huge problems trying to get it to run on a console".

Testing, testing

With so many possible combinations of hardware, the other major obstacle for multi-platform game developers is testing. Baranec

all the versions could be coded simultaneously and be released at the same time.

"I get a bit leery when people say that *Dead Space* for PC was a port," says Bozz, aware of the negative implications of the word, "because it was co-developed. A lot of the code was co-developed in roughly the same timeframe as the main game, and you can't do that if you're just porting code." According to Bozz, it took the Melbourne team about ten months to go through the whole process of developing the PC version. "Once the shared core code is setup on the PC," says Bozz, "you really start chipping away at the various rendering effects and some of the custom code that's written for things such as level-loading."

Saving and loading

The process of saving and loading content varies between consoles and PCs. PC gamers have become accustomed to being able to

save a game anywhere, and they also expect quick level-loading times. On the other hand, many console games only let you save at particular points in the game, and can also stop to load data regularly.

This is particularly true on the Wii, which only has a 64MB GDDR3 memory chip for RAM and 512MB of flash memory for data storage. "The biggest challenge on the Wii for us is that it doesn't have a lot of memory," says Telltale's Bruner, "and our style of game is challenging in that regard, because we're not level-based; we have everything in a one-off piece of content. This is very different from an action game where you have a shoot animation that's played over and over again from memory, and you can clean stuff up in level loads."

Bruner says that you only have 40-50MB of working RAM to play with once the Wii is up and running, and this is why you'll see a lot more in the way of loading screens on the Wii version of Strong Bad than you will in the PC version.

The amount of memory available isn't the only issue here; the way in which consoles and PCs manage memory is also a crucial factor. "On the 360, you have 512MB of memory arranged in a shared memory architecture," explains Baranec. "On the PS3, you have 256MB of CPU RAM, 256MB of GPU RAM and 256KB of RAM per SPU. On the PC, you have a basically bottomless pit of CPU memory, and a rather large amount of GPU memory, but the two are tied together in a very inefficient way."

According to Baranec, the radically different memory systems mean that you have to structure your code differently with each platform. "Let's say you had 100 character skeletons that you wanted to animate for a frame," says Baranec, "while some of the core math bits remain common – the way you 'splat' the processing of those skeletons across multiple processors is completely different between the PS3 and 360. You're just going to

have to buckle down and write it twice."

The Wii also creates problems when it comes to saved games, as Nintendo has specific rules about what you can do with the flash memory. "You can't write to the flash very often," explains Bruner, "so you're limited in the amount of writing you can do." A developer also isn't allowed to dynamically change the size of a saved game file on the Wii, as gamers always need to be able to save their game in the same amount of space. This means that a Wii developer has to predict a worst-case scenario for its save game data and stick to that file size.

This doesn't just apply to the Wii though. Microsoft also has specific rules about what you can do with save games on the Xbox 360, particularly as the console's roaming feature enables you to take your machine's hard disk to another machine and still use your saved games. "There are all kinds of strange rules and regulations with save games on the consoles," says Bruner, "and you don't bump into those problems on the PC." The upshot of this is that multi-platform games have to be developed with these restrictions in mind, so restrictive save games often crop up in the PC versions of multi-platform games.

Telltale specifically tries to make the best of each platform's save game system, and this can be seen in the developer's episodic Strong Bad games. Both the PC and Wii versions allow you to save the game at any point you like, but the save games on the PC version actually communicate with each other, so objects that you collect in Episode 1 will also be available in Episode 2 and so on – this can also be seen on the Desoto stickers in Sam & Max Season 2 for instance.

This can't be done on the Wii or the Xbox 360, as Nintendo and Microsoft forbid save games to communicate with each other. "It makes sense," explains Bruner. "You wouldn't want a Telltale game to see your Call of Duty score." As a result, Telltale had to create the illusion of save games that can talk to each other on the console versions of its games. "We knew what might have happened in Episode one and what was guaranteed to be there," says Bruner. Telltale is apparently in talks with both Microsoft and Nintendo about getting around the system, but currently developers still have an advantage with the PC's flexibility when it comes to save games.

It's worth remembering that, despite the fact that two of the current consoles have hard drives, console gaming has grown up around the basis of small amounts of space on flash memory cards and game cartridges, which means limited space and a limited number of writes too. As such, a culture has developed around save points in console games, which isn't necessarily a bad thing. You could argue that it's better to be able to save everything whenever you want, but you could also argue that this prevents you from playing the game properly.

The latter was the attitude when developing Dead Space, which notably doesn't feature



A further complication for designing a save game system on the Xbox 360 is its roaming feature, which lets you move your save games to another machine.

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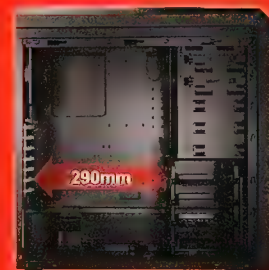


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Dead Space allows a lot of control over graphics features such as the shadow effects to ensure that a wide range of PCs will be able to play the game.

a Quick Save button on the PC version. "If you're able to save right before a specific state," Baranec explains, "then you're able to make the game a lot easier because you can prepare yourself. You can be geared up and ready to go before a major battle. If the save spots are where we put them, then you've got a longer length of gameplay time where you need to have your act together. The game is specifically tuned to make you get to the next spot before you can save again, and you have to manage your ammo and health all the way through. Dead Space was designed to be a survival horror game, and this includes resource management. You're supposed to be attentive to what you're doing with your resources and your ammo, and if you can save anywhere then that blows that all away."

Controls & cameras

Other common complaints about PC ports of console games are the controls and the camera angles. PC gamers expect to be able to play most games smoothly with the keyboard and mouse, and they also expect a first person point of view, rather than a third person or over-the-shoulder view. This contrasts starkly with console games, which generally have to be controlled smoothly by a static gamepad, and often need slightly different camera angles to make this smoother.

With regards to camera angles, Beaver says that it isn't actually a hard job to move a game from a third-person point of view to a first-person point of view, but it's a lot of work if you do it the other way around. "It's always more difficult to go from first-person to third-person," says Beaver, "because essentially you now have a character that's dragging a balloon behind them, and that balloon is the camera. It can get caught on geometry, and it can snag and get caught up in objects, and that becomes the bigger problem. If you're going from third-person to first-person, that's pretty much a subset of the camera work you already have, so it would be relatively easy on a PC to go straight to first-person perspective."

So why do so many console ports still have third-person camera angles on the PC versions? Again, this appears to be because the game was designed from the start to incorporate a third-person view, to the point where it's an integral part of the gameplay. In the case of Dead Space, Beaver explains that "it was important that we didn't go to a first-person view; the character [that you play] was our avatar and he was also often a victim of the violence and carnage, and we wanted you to see that".

Visceral wanted Dead Space to closely mirror the gameplay on the consoles in the PC version, and according to Beaver, this meant locking the controls in the PC version. "The UI producer was also in charge of the PC SKU," says Beaver, "so he was in charge of making sure that the controller mapped well to the keyboard. When he was working on that he found that we couldn't really keep keyboard remapping, which is pretty traditional on games – you can claim whichever keys you want. We had to have a separate keyboard layout in place and lock it in because the controls are very specific, and we had a lot of unique things happening on the controller, and once we mapped them to the PC keyboard they needed to stay in place. But it was very successful so I think it worked."

Meanwhile, Telltale has taken a slightly different approach to multiple controllers. Making the jump between the PC and the Wii wasn't hard, because the Wii functionally has a cursor, making it practical for point-and-click games such as Sam & Max and Strong Bad. However, a new control system had to be developed for Wallace & Gromit if the games were going to run on the Xbox 360 as well. Telltale's way around this is to develop all its games on the PC first (Bruner says there are no console dev kits at Telltale), but work with multiple controllers in its in-house development software, called Tool.

"When you're working in the Tool on the PC," says Bruner, "the Tool has an abstract notion of this crazy Frankenstein controller, which has a keyboard, a mouse or two, two analogue joysticks and a bunch of buttons and

accelerometers. So, from the Tool's point of view, you can code for all the different inputs that the Tool supports. We're trying to come up with a control scheme that's successful across all platforms. We don't want to end up making two or three different control schemes that we have to get right, as opposed to one that works in a lot of different contexts."

Conclusion

An inherent problem with multi-platform game development is the inevitable tension between the fact that much of the code is ported, whereas the core game itself is always going to be geared towards one platform.

Economics dictate this platform will increasingly be a console, so as PC gamers it's likely that we're always going to have to put up with issues such as limited save games and strange camera angles. However, it's often worth persevering with these if the game is good enough to shine through and you should remember that not all multi-platform games are bad. Fallout 3, Call of Duty 4, Mass Effect, Dead Space, Psychonauts and Beyond Good & Evil all appeared on consoles as well as PC, but it's still well worth playing them on the PC because fundamentally, the games are great and the developers took care to make sure the code wasn't compromised.

What's more, PC gamers are now at least being taken seriously by multi-platform developers, and we're now getting a lot more in the way of advanced graphics options.

So, the next time you complain about a PC game being a 'port', think about the reasons why the game isn't quite what you expected. Are the camera angles and limited save points really a product of lazy porting, or are they essential parts of the game experience? There's a stereotype that says that PC games should have a first-person view and a fully featured save game system, but there's no reason why you can't make other styles of game work on the PC. Be open-minded – there's a whole new world of fun from all sorts of different games, even if they don't have exactly the same control system as the one you're accustomed to using. ☺

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HARDWARE

NEWS, REVIEWS AND ROUNDPUPS ON THE LATEST HARDWARE

The jewel in the crown of this month's Hardware section is our simply mammoth motherboard roundup. Though the rest of the review section is pretty neat, too!

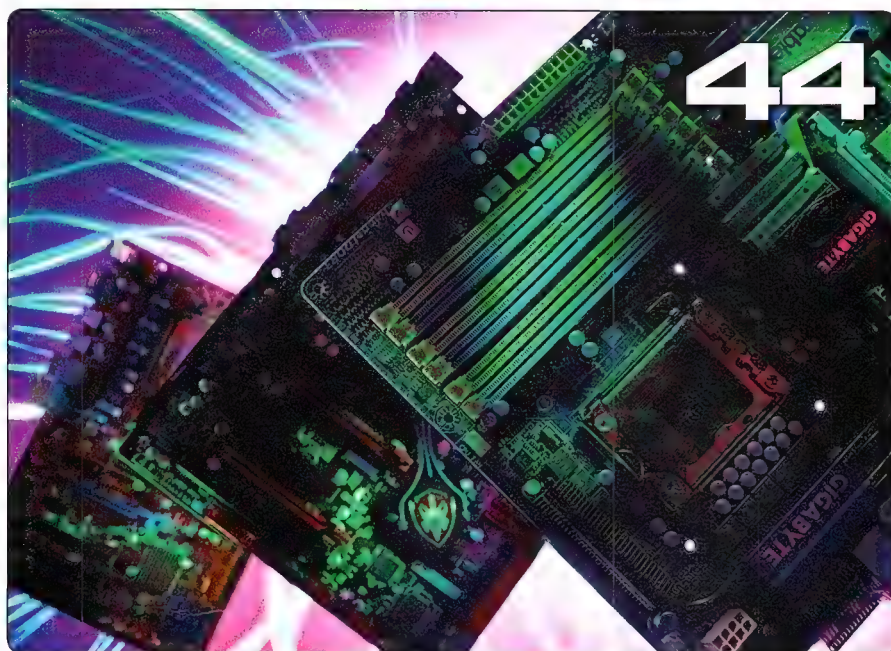
We've got new graphics cards from XFX, EVGA and MSI, the latest AMD CPU, and new RAM and SSD from OCZ. Aside from a plethora

of acronyms, there's also a new Raven case from Silverstone, cooling from Thermalright and newcomers Aywun, and new gear from Creative and Razer.

On top of all that, we've also got a new and expanded KitLog section for all your system building needs. Made of win.

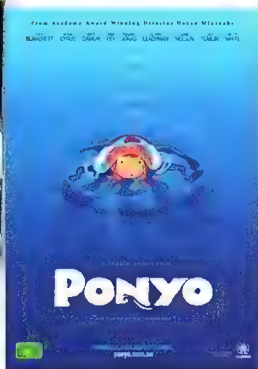
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www.atomicmpc.com.au/competitions

Athlon II X2 250 3GHz

Limited by design.

Street Price \$124 Supplier AMD

Website www.amd.com

Specifications 3GHz dual core; 45nm manufacturing process; 'Regor' core; 128KB L1, 2048KB L2; 15x multiplier; 65W TDP; AM3.

AMD's Athlon chips have been revered with legendary status in their long and illustrious lives; the lineage goes from the Thunderbird and all the way up to the bloody good Athlon 64 (online here: www.atomicmpc.com.au/?25051). What we have here isn't AMD's premium CPU by a long shot however, instead slotting in as the ultra-value cheapie chip. The company's stripped a lot out of this Athlon to get the price down so low, but what was axed makes this chip a pretty average choice.

Still built on the 45nm manufacturing process that all of AMD's current lineup are, the die is codenamed Regor to indicate this specific lineup. It only has 234 million transistors, and a small die size of 117.5mm², with a Thermal Design Power of 65W. The chip is packaged on the AM3 socket which means that it contains an integrated DDR3/DDR2 memory controller, which gives plenty of bandwidth. This is no longer a feature that is exclusive to AMD since the introduction of Intel's Nehalem, but the dual compatibility still gives you a nice choice.

AMD's engineers have taken to the die with a large blade, slicing away a great many essential components that aid performance. Most noticeable is the L3 cache – a whopping 6MB of it is on the Phenom II 550, featured last Issue for only \$145 – but here there's no L3 cache here whatsoever. We've only got the small L1 Data/Instruction caches at 64kb per core, and 1MB of L2 cache per core for a total of 2MB. The loss of so much speedy cache definitely has an impact on benchmarks, with wPrime taking a significant performance hit and other multithreaded apps suffering. Typically the two cores will 'fight' over available L3 cache depending on their need, splitting it up according to processing load, but

the limited space in this budget chip leaves them with a very antiquated amount of headroom.

This is definitely a value chip, and as such doesn't come with an unlocked multiplier. Sitting at 15x stock, it can be lowered down to 4x in half-increment steps but not increased, meaning that the HT bus will require increasing from the stock 200MHz to give any increase in speed. Also of note is that AMD is finally listing these chips as being manufactured by its spinoff fab GlobalFoundries, something that made a lot of financial sense to them at the time.

Throwing the chip underneath our TRUE heatsink and setting the benchmarks going gave us pretty average results – for a CPU from a few years back. We got lower scores across the board compared to a Phenom II 550, though the heat generated under load wasn't even enough to make the heatsink noticeably warm compared to room temperature. The ability to be cooled by a breeze notwithstanding, stock performance was

quite disappointing considering you can spend a little more and grab that Phenom II, but what about when overclocked?

While this was a bit quirky to begin with thanks to Cool N Quiet dropping the multi to 4x even when running benchmarks; we turned that off and eventually managed to tweak a final HT speed of 252MHz at the stock multi of 15x, giving a final speed of 3787MHz. This felt quite low, so the multi was brought down two steps to 14x and the HT increased to its highest limit. Unfortunately not even a multi drop helped; hitting 270MHz to reach a final 3780MHz.

With lower performance across the board, worse overclocking performance and no L3 cache, this is a silly choice for practically any build. **JR**



Athlon II X2 250 3GHz

	X2 250 200x15; DDR3-1333 7-7-7-21	217x15; DDR3-1446 7-7-7-21	230x15; DDR3-1532 7-7-7-21
PiFast	38.36s	35.44s	33.56s
wPrime 32M – single thread	48.25s	44.538s	41.792s
wPrime 32M – multi-thread	24.383s (1.98x efficiency)	22.37s (1.99x)	21.387s (1.95x)
CineBench R10 64-bit – single thread	3369	3659	3858
CineBench R10 64-bit – multi-thread	6577 (1.95x efficiency)	7024 (1.92x)	7489 (1.94x)
Everest Read	7983MB/s	8599MB/s	8958MB/s
Everest Write	7070MB/s	7643MB/s	8082MB/s
Everest Latency	53.4ns	49.3ns	48.1ns



EVGA X58 Classified

For your eyes only.

Street Price \$630 Supplier EVGA

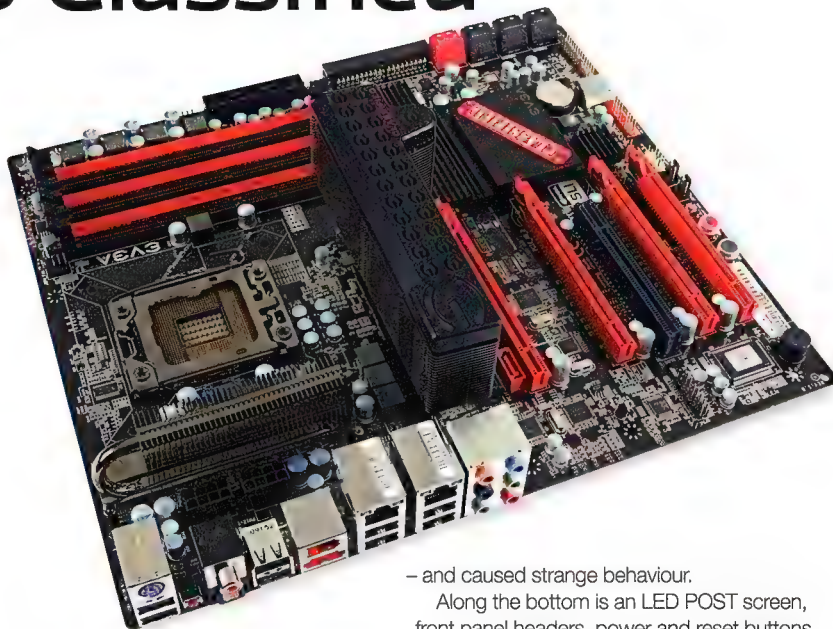
Website www.evga.com.au

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 4x PCIe x16; 1x PCIe x1; 1x PCI; 1x EIDE; 8x SATA; DDR3-1800

Gallery www.atomicmpc.com.au/?149444

A name like Classified conjures up all kinds of things, most of which have almost nothing to do with motherboards, but exactly what secrets are there hidden in this one? Truth is... not much, but what is there is a pretty solid offering with everything that we'd expect from the Eternally Vaunted Grand Artists at the EVGA design team. Can they mash their heads together enough to make this board a secret worth coveting?

Built around the X58 chipset that we've seen used in other mobos, the Classified manages to bury it beneath a very swish custom heatsink. It's so pretty that we fell in love with it almost instantly, lusting over the three heatpipes and nickel-plated base of the northbridge heatsink wedge – and drooling over the smooth black surface of the southbridge. Even the power regulation is treated to a very nice nickel-plated heatsink, and certainly every component that usually gets quite warm under load was well managed. There's even a custom waterblock that you can buy for this mobo to give it an extra



layer of cooling, but if you're sticking to air then there's plenty of room around for big heatsinks.

Starting at the I/O ports there are PS/2, eight USB, clear CMOS, Optical/Coaxial, Firewire, eSATA, twin Gigabit, 7.1 channel audio available, running off the Realtek ALC889 audio chip. Just behind these are two 8-pin CPU power sockets (yes, two!) that offer an extra place to plug in for those power supplies with dual connectors; but for most cases a single plug is more than you'll need. The 10-phase digital PWM is next, managing the power for the CPU and other components.

Three times the usual gold content has been stuffed into the LGA1366 socket of this mobo for better contact, but the six DDR3 slots are the same as any X58 board. A right-angle IDE sits next to eight right-angle SATA ports to give a nice expansion area, but we found that having an IDE device installed at the higher end when overclocking actually inhibited performance – removing the drive gave an extra 2MHz QPI

– and caused strange behaviour.

Along the bottom is an LED POST screen, front panel headers, power and reset buttons and even a clear CMOS button. The expansion slots give room for TriSLI, but will run at all 8x with more than two cards. They can also do Crossfire up to three cards. A single PCIe x1 slot sits at the top, but is squeezed into a small space right next to the X58 chip and is too cramped for most soundcards.

We set out 'clocking this board, and after a quick BIOS flash to the latest version we found that the CPU multi detected as 25x (24x stock), but correctly detected as 24x under Windows. The overclocking options were well laid out and impeccably described, with plenty of profile save slots for settings and a lot of control over voltages. Unfortunately under air we didn't quite hit the 164 of the EVGA X58 SLI board, but we got it to 162 which isn't too bad.

Subzero cooling is where this board is designed to shine, but at \$630 it's a lot to ask.

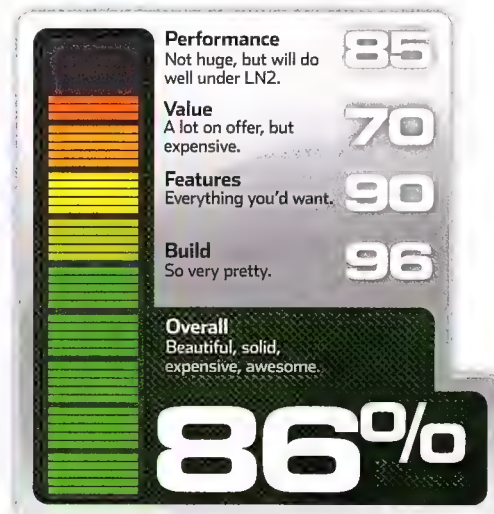
This review will now self-destruct. JR

Overenthusiastic

This mobo has a fancy-pants PWM, but that doesn't always mean it's great or reliable – under testing we found that it ran the Vcore at 0.2V higher than set in the BIOS. Set at 1.4V meant that the CPU was burning away at 1.6V; it took 1.19875V to give us an effective 1.4V under use. This was the latest BIOS too, so could be potentially bad for those out there who are less attentive. Be warned!

EVGA X58 Classified

	133x24; DDR3-1600 8-8-8-24; 3.2GHz	150x24; DDR3-1500 8-8-8-24; 3.60GHz	160x24; DDR3-1604 8-8-8-24; 3.84GHz
PiFast	26.42s	23.69s	22.08s
wPrime 32M – single thread	41.486s	36.423s	34.11s
wPrime 32M – multi-thread	7.672s (5.41x efficiency)	6.766s (5.38x)	6.391s (5.34x)
CineBench R10 64-bit – single thread	4687	4920	5547
CineBench R10 64-bit – multi-thread	18525 (3.95x efficiency)	21084 (4.29)	22379 (4.03)
Everest Read	17422MB/s	15813MB/s	17501MB/s
Everest Write	13907MB/s	13480MB/s	14382MB/s
Everest Latency	49.3ns	51.0ns	48.0ns



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Twin Frozr on GeForce GTX 285



v.s. Reference cooler on GeForce GTX285



N285GTX SuperPipe 1G (OC)



- GeForce GTX 285 GPU
- 240 Core Processors
- 1GB 512 bits GDDR3 Memory
- SuperPipe Technology
- DirectX 10 Support

N275GTX Twin Frozr (OC)



- GeForce GTX 275 GPU
- 240 Core Processors
- 896MB 448 bits GDDR3 Memory
- DirectX 10 Support

N260GTX-T2D896 (OC)



- GeForce GTX 260 GPU
- 216 Core Processors
- 896MB 448 bits GDDR3 Memory
- DirectX 10 Support

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MSI P45-8D Memory Lover

Boom chikka wah wah.

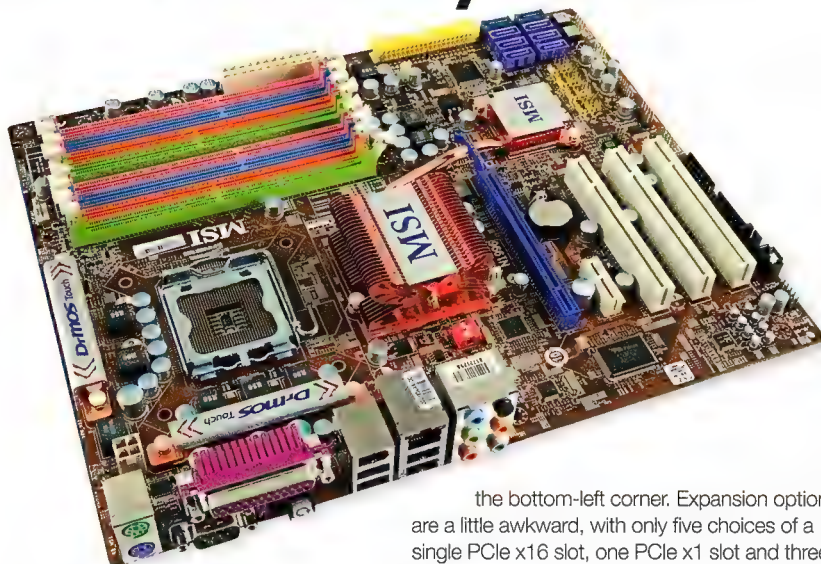
Street Price \$226 Supplier MSI

Website www.msicomputer.com.au

Specifications Socket LGA775; Intel P45 chipset; ATX form factor; 1x PCIe x16; 1x PCIe x1; 3x PCI; 1x EIDE; 8x SATA; DDR2-1066, DDR3-1333

Inside a brightly coloured box coated with images of memory sticks cunningly blurred with Photoshop to (barely) disguise the actual origin of them lies the P45-8D Memory Lover. Assuming from the name that this is to be taken quite literally, what we expected was a motherboard with huge capacity and compatibility for RAM, and we got that – more or less.

Powered by Intel's P45 chipset – the current mainstay for most Core 2 Duo/Quad users – the Lover hooks up with the memory controller in the Northbridge for both DDR2 and DDR3 memory at once. This threesome results in eight slots for memory DIMMs opposed to the usual four, and therefore can run either memory type in dual-channel. However one thing it *cannot* do is run DDR2 and DDR3 at the same time. Purportedly to enhance upgradeability this is actually a little odd, since DDR3 doesn't offer huge performance benefits compared to the



previous generation and money would be much better spend on a CPU upgrade.

The I/O options here are as quirky as the amount of memory slots, with two PS/2, a serial and parallel port, clear CMOS button, four USB, Firewire, Ethernet and 7.1 channel audio powered by a Realtek ALC888 onboard chip. Why this was limited in the USB department is curiously confusing, but the space just behind these ports is quite good and has plenty of room around the LGA775 socket for big heatsinks. The Northbridge chip sits a little close to the socket for our liking, but no clearance issues arose with the TRUE. Power options onboard are the usual 24-pin power for mobo, but the CPU is limited to a 4-pin socket.

Expansion options along the right hand side of the board are pretty good, with a right-angled IDE port and eight vertical SATA ports. Hard power/reset buttons are included in that same corner, as well as front panel headers and four USB headers (hey, we found where the I/O panel wound up!). A Floppy port lies along the bottom edge of the mobo, while the audio header is in

the bottom-left corner. Expansion options are a little awkward, with only five choices of a single PCIe x16 slot, one PCIe x1 slot and three PCI slots. Thankfully the SATA ports are out of the way of the PCIe x16 slot, but this is still quite limiting for newer devices that will use PCIe, which are sure to come in the future.

The Northbridge and Southbridge chips are cooled with a simple copper heatsink and one heatpipe joining them, while the power phases for the board are treated to little copper heatsinks of their very own. Oddly the Northbridge heatsink is shaped just like a butterfly, but it also manages to keep things acceptably cool even under load.

The BIOS for the Lover is laid (*giggle*) out very well, with options spread nicely as we delved into the features inside. All the usual choices are there as well as some odd ones, but we still managed to push our E8400 up to a max FSB of 480MHz on a 8x multi, or 3.84GHz. Performance wasn't comparatively as good as GIGABYTE's P45-UD3P, but was quite solid for the options available. For those who want eight slots, this Lover is the board for you. **JR**

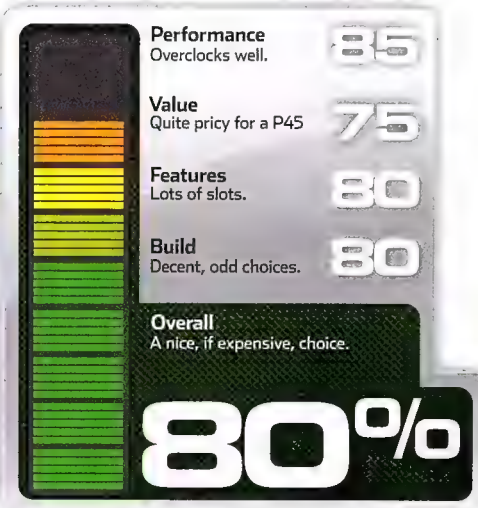
MSI Madness

We've seen some odd stuff in MSI BIOSes before, but the Dynamic Overclocking Technology (DOT) had some funny names – and resulted in absolutely no performance increase. The highest setting returned a Cinebench multi score of 7110, so check them out below:

- 1% - Private
- 3% - Sergeant
- 5% - Captain
- 7% - Colonel
- 10% - General
- 15% - Commander

MSI P45-8D Memory Lover

	E8400	333x9; DDR2-1066 5-5-5-15	378x9; DDR2-1008 5-5-5-15	423x9; DDR2-1015 5-5-5-15
PiFast		31.31s	27.39s	25.05s
wPrime 32M – single thread		50.653s	44.819s	39.967s
wPrime 32M – multi-thread		25.849s (1.96x efficiency)	22.963s (1.98x)	20.499s (1.96x)
CineBench R10 64-bit – single thread		3722	4200	4680
CineBench R10 64-bit – multi-thread		7172 (1.93x efficiency)	8119 (1.93x)	8768 (1.87x)
Everest Read		7028MB/s	7886MB/s	8365MB/s
Everest Write		7106MB/s	8038MB/s	9012MB/s
Everest Latency		72.6ns	64.2ns	63.9ns





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XFX GTX295

Single-sided sandwich.

Street Price \$729 Supplier XFX
Website www.xfx-force.com

Specifications 576MHz core; 1008MHz memory (2016MHz effective); 1242MHz shader clock; GT200 core; 240x2 stream processors; 1792MB GDDR3; 448-bit memory interface; dual slot PCB with active cooling; 6-pin, 8-pin PCIe power connector

Card info www.techpowerup.com/gpuz/gfx2b

When the first design of the GTX295 hit bang-smack at the start of this year, it was a pretty neat piece of PCB(s) that was very different to most cards out there. Essentially two entire PCBs printed out, filled with components and slapped together with a heatsink in the middle, they were sandwichier than you'd expect. This dual-PCB design was pretty expensive to produce, requiring almost twice the materials to create, so NVIDIA engineers went back to the drawing board and managed to squeeze everything all onto the one lump of PCB.

Returning with the same GT200 cores complete with 240 stream processors each, there's a cut-down memory bus of 448-bits width but no restriction on the memory capacity. Of course due to space being at a premium, the 1792MB of GDDR3 memory sits on the back side of the PCB (with each GPU getting 896MB). This card isn't overclocked like most of the XFX cards we see, but as we'll see in a minute that doesn't mean it can't be pushed.

An all-black PCB looks really cool with the huge black shroud, and the green stickers on it leave no wiggle room for misidentifying the card as anything else but NVIDIA. A huge 92mm fan sits in the middle of the card, sucking in a phenomenal amount of air with its thick blades and spreading the cool air either side. While this does mean that some of the heat is gonna



be dumped inside the case, it is very good at getting it out of the card quickly. Rather than a shared heatsink for both cores, they're each treated to a solid aluminium slug that rises upwards into aluminium fins. Each 'sink has a lot of heft to it, packing more metal into this one card than into your average Ford, and giving the card a funny deadzone in the middle where almost no weight resides.

On the flipside of the card we find the GDDR3 memory we mentioned before, which is treated to an oddly-textured black aluminium plate. Under load we didn't feel any part of the card get uncomfortably warm like the original design; even going so far as to be cool enough to hold throughout a benchmark run! Actual idle temps were 40 at 56.4dBA, and load only hit 53 degrees with 59.4dBA. At load this new design is two degrees cooler than the original was at idle, while knocking along at a maximum

noise of 5.9dBA less too! It's only so often that a redesign actually manages to make such a huge improvement, and one that we definitely noticed while overclocking; hitting a final clockspeed increase of 23 per cent to 711MHz (+135MHz) and memory of 18 per cent to 1187MHz (+179MHz). This was perfectly stable, and only made around 65 degrees of heat – why they didn't invest the effort into making a design this good to begin with is confounding.

Performance was exactly where the original design was (as they share identical specs), hitting 19.5k in 3DMark 06 (just below a 4870X2), and P21740 in Vantage (much higher comparatively). Crysis and GRID were burnt through faster than an inattentive wafflemaker's charred goods, giving a way-more-than-eyeballs-need level of frames in both. There isn't much that this card can't inhale and devour, and XFX is even kind enough to throw in a free Vantage key worth \$US20 and a copy of Far Cry 2.

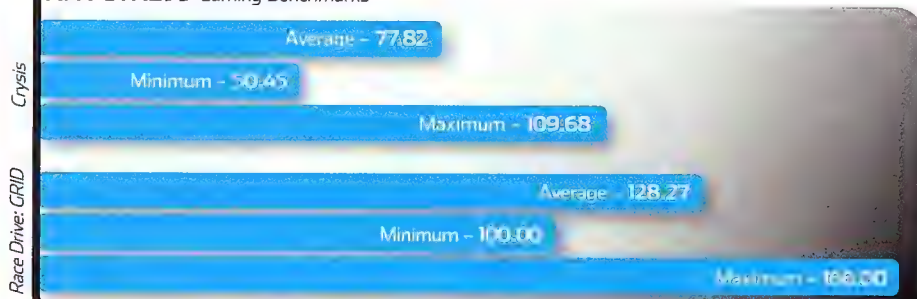
With improvements in every way over the original, you'd be absolutely mad not to grab this version over that toasty sandwich. **JR**

XFX GTX295 3d Mark scores



Score

XFX GTX295 Gaming Benchmarks



Frames per second

Performance

Mad OC, great benches.

97

Bundle

Vantage is nice, Far Cry 2 great.

90

Value

Very cheap for this much speed.

88

Build

Awesomeness embodied.

98

Overall

A faultless win for XFX's GTX295!

96%

MSI N260GTX Lightning

ZAPP!

Street Price \$449 Supplier MSI
Website www.msicomputer.com

Specifications 655MHz core; 999MHz memory (1998MHz effective); 1404MHz shader clock; GT200 core; 216 stream processors; 1792MB GDDR3; 448-bit memory interface; dual slot PCB with active cooling; dual 6-pin PCIe power connector

Card info www.techpowerup.com/gpuz/2cypk

Before you think too hard about the arrangement of the letters in the name of this card, no, it isn't a mistake – MSI have named the N260GTX *backwards* compared to every other GTX260 card out there. Why this was done is a complete mystery, but even the packaging claims extraordinary things, even going so far as calling it military-specification quality. This is a dubious one that isn't backed up by anything we could find apart from the box itself, but nothing we discovered hinted at any added reliability or tweaked design.

What we did find was a pretty standard GTX260 card, based around the GT200 core from NVIDIA with a cut-down complement of 216 stream processors. It runs at a clock speed of 655MHz, which is a decent 79MHz overclock above the reference design, though the memory speeds remain the same. The GDDR3 memory packed in here is a whopping 1792MB on a wide-ish 448-bit memory bus, an absolutely decadent (and ultimately excessive) amount of memory that offers huge amounts of space. Just keep in mind it'll add itself into the system memory limits for operating systems; if you haven't moved to a 64 bit architecture yet, do so before picking one of these up. The core is manufactured on a 55nm process, but still needs two 6-pin PCIe connectors to guzzle down electricity.

Heatsinky cooling is the order of the day, with

9% OC



the standard twin Frozr cooler whacked on that offers five nickel-plated heatpipes underneath a large shaped aluminium plate, plenty of aluminium fins and a solid copper base. It's got two dinky little fans, and at about 70mm each they work in tandem to keep the card cool. They work well; with 49 degrees idle at 58.1dBA and 56 degrees load at 57.8dBA. While it might sound odd (no pun intended) to be quieter at load with the fans spinning faster, the flimsy blades made an audible wobbling noise at lower RPMs that added to the overall noise generated. Annoying!

Overclocking this card was pretty easy thanks to the Frozr MSI had thoughtfully stuck on, but we found that we could only push it an additional nine per cent to 712MHz (+57MHz) on the core (hindered by the factory overclock), but we could also only manage a disappointing extra three per cent out of the memory chips. This was pretty perplexing as they are covered by a thick aluminium heatsink, so should be fine.

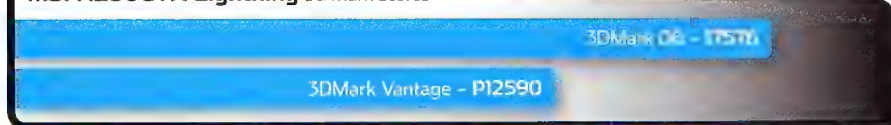
No game is included with this card, but instead MSI packed in a little 5.25in bay device called the AirForce. It's an aluminium-faced touch-sensitive LED panel that can be used

inside or outside a case thanks to a mini-USB or internal USB header cable, which couples up to the

Lightning software (also included) to allow overclocking (presumably aiming to make it even more accessible and easy). In principle this is a great idea, but what we actually found was a frustrating little black box that merely blinded us with its too-bright LEDs and functioned as well as James Bond's liver. It comes with Game, Office, Power Saving and Theatre presets that all supposedly change the frequency of the card, though only the first three did anything. Theatre merely allowed the brightness and contrast of the LCD monitor to be changed, and no frequency settings in any of the profiles did anything when changed. There is also a Default/Reset buttons that winks suggestively at you – but again does nothing at all.

The AirForce drives the price of this card up into the stratosphere by a few thousand feet, so we really can't recommend this to anyone but those who like pretty lights. And, well, there are a lot of them... **JR**

MSI N260GTX Lightning 3d Mark scores

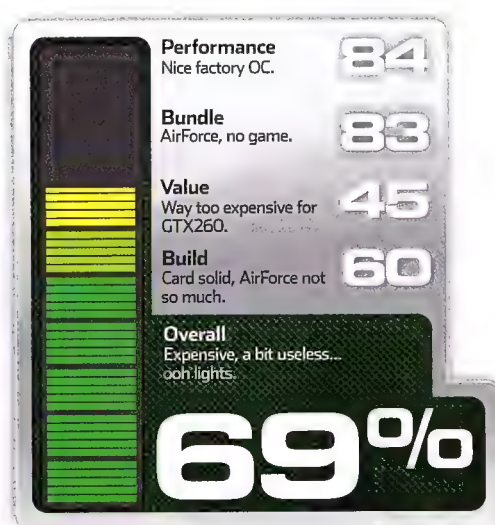


Score

MSI N260GTX Lightning Gaming Benchmarks



Frames per second



EVGA GTS250

Less doof-doof, more gaming.

Street Price \$215 Supplier EVGA
Website www.evga.com.au

Specifications 756MHz core; 1100MHz (2200MHz effective) memory; 1836MHz shader; G92 core; 128 stream processors; 512MB GDDR3; 256-bit memory interface; dual-slot active cooler; one six-pin power connector

Card info www.techpowerup.com/gpuz/7yfs9

Graphics cards don't usually contain fuel-injected engines within their sleek silicon bodies, so the picture on the front of this one is a little misleading. What it does tell (or at least hint at) is that this card has had a little tweaking under the hood, courtesy of the engineers at EVGA. Sadly a teensy overclock is the only thing different here, bumped up from a stock core clock of 738MHz to a grunter 756MHz. Just like a hotrodder will tune their engine to show off to their peers, so have EVGA – the difference is that this isn't all that astounding. Built around the same G92 core that has been used in ten bajillion cards since its inception, this is essentially the equivalent of buying a V3 engine for your supercar shell – it just doesn't have enough cylinders to give a decent amount of power. There are only 128 stream processors here compared to the GTX285's top-of-the-NVIDIA-pile 240 processors, which really hurts. A standard fuel tank with enough for 512MB of datafuel keeps the card running, connected with a 256-bit memory bus. GDDR3 is naturally the order of the day, and has been used for quite some time in these kinds of cards.

754 million transistors burn through calculations inside the core, producing a sedate 37 degrees and 55.4dBA idle, but ramping up to 65 degrees and 58.3dBA with the pedal to the metal. This is pretty typical and shouldn't be too loud inside a case with other fans whirring away.



The cooler fitted to this card is your bog-standard reference design, with a squirrel-cage fan at one end sucking in cool air to pull through the rest of the card. There are a series of aluminium fins mounted to a solid aluminium block, which is extruded to run the length of the card and also cools the memory chips. All the solid capacitors and power regulation bits are hidden underneath the cooler's black plastic exoskeleton. A PCIe 2.0 slot is included as standard (with leather being an optional extra). Since this core doesn't need huge amounts of power to run only a 6-pin PCIe connector is needed, and EVGA include a molex adapter in the box just in case. Display options are pretty standard too at two DVI and a single analogue video out, with two SLI nipples at the top of the card and an SPDIF header to pipe digital audio through the DVI port, eventually hitting HDMI through an adapter straight into an amp or TV.

EVGA also threw in a copy of its Precision overclocking tool, which runs much like Rivatuner but works especially well with EVGA cards. Don't bother getting it from EVGA's site (you need to register), but there's plenty of other sites with it if you want to have a play around. We overclocked the card with our usual method; raising the core clock while tied to the shader clock, then the memory, and finally a run-through to make sure the settings are good. Our final speed was up 13 per cent to 855MHz on the core (+99MHz), seven per cent to 1180MHz on memory (+80MHz) and 2076MHz on the shader (+240MHz). This is an adequate result, but didn't offer huge amounts of performance.

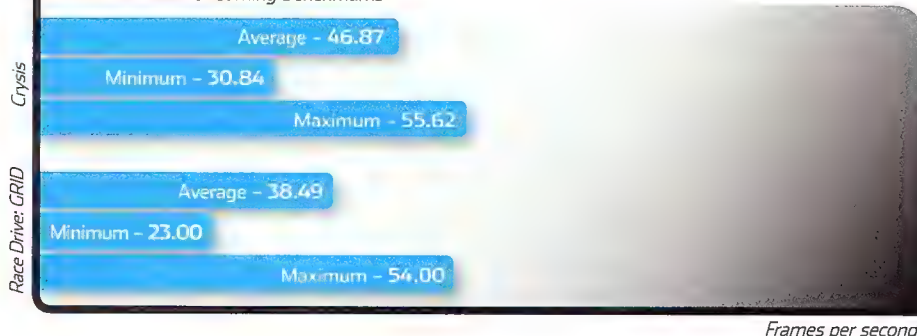
The small stock overclock did give a noticeable change though, gaining a few hundred points extra in 3D06/Vantage. It went competently in Crysis, but as soon as it hit GRID's large resolution and settings it crapped out a bit, the 512MB memory filling up quickly and causing significant slowdown. This card is a decent value choice for budget gamers, but for those playing at high res or higher quality settings, look elsewhere. **JR**

EVGA GTS250 3d Mark scores



Score

EVGA GTS250 Gaming Benchmarks



Frames per second



Silverstone Raven RV02

No Poe references – honest!

Street Price \$220 Supplier Altech
Website www.altech.com.au

Specifications 212 (W) x 503 (H) x 643mm (D); 5x 5.25in drive bays, 3x 3.5in drive bays, 1x 2.5in (SSD) drive bay; 1x 120mm exhaust fan (top), 3x 180mm intake fans (bottom); 2x USB2.0, 1x audio, 1x MIC; ATX & mATX compatibility; reinforced plastic, steel body.

Gallery www.atomicmpc.com.au/?147300

We loved Silverstone's last Raven case, the RV01 (review at <http://www.atomicmpc.com.au/?141417>), unreservedly. For a case that we actually had some reservations about when we started to look at it, it quickly dawned on us that Silverstone was really pulling out all the stops to create a rather unique, practical and striking design. The RV02 is the 01's slightly littler brother, and it's another win for Silverstone.

The RV02 seems a lot longer than a lot of cases, but that's because it's lost about six inches in height compared to most tower cases – as such, the dimensions do seem a little odd, but it's something that's easy to get used to. The same stealth-inspired lines give the 02 a low and sleek look, and the power and reset buttons are well-made, and highlighted by a nice LED strip that almost makes the case look as though it has some Cylon blood in its heritage.

Internally, pretty much everything looks like it was designed in Bizarro World, but in a good way! The motherboard sits on the left-hand panel of the case, the reverse of pretty every other case design. This is because the mobo orients such that the expansion slots point out the top of the case, just like the 04. A plastic shroud hides unsightly cables from things like video and sound cards, as well as the power cable – the PSU orients upward as well. The

cables are channelled to the upper rear of the case by a cable-guide-cum-carry handle – very practical!

The great thing about this design is that since hot air naturally rises, the single exhaust fan is more than adequate to keep the case ventilated – especially when you consider the three 180mm fans pulling in air from the case's underside. This does leave your drives a little un-loved, but the open interior should still provide enough airflow for all but the most intensive of RAID arrays.

Another good side effect of venting hot air upward is the fact that you can place this case hard up against a wall without hindering airflow. If your computing/gaming space is pushed for room, this could be a Godsend.

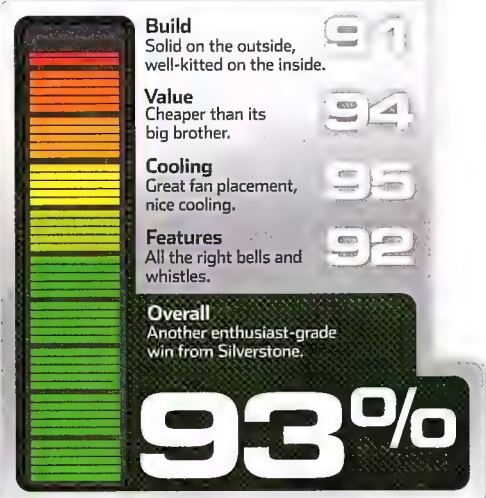
Build-wise, the Raven's a mix of matte black plastic and steel – it's not the lightest case, but it's well built. The drive bays are secured by a push-button tool-less clasp, and there's even an SSD bay – very forward thinking! Thankfully, Silverstone seems to have been paying attention to our general dislike of tool-less solutions for expansion cards, and has instead stuck with good old reliable screws. Bless. There are two watercooling grommets on the case's underside, and there are filters on the lower fans that can be removed for cleaning.

About the only serious limitation of the RV02 is



in terms of the larger graphics cards – the interior space only allows for cards of no more than 10.5in – that's pushing some of the larger cards we've seen come through the labs recently. If you've got a monster, custom-cooled video card, this case is probably not for you.

For everyone else, though, this is a great – and well-priced – case, heaped with features and dripping with class. Just make sure you do a good build, so that you can show off with the windowed panel! **DH**



OCZ Blade PC3-16000 kit

Three of the fastest sticks this side of a tree.

Street Price \$599 Supplier OCZ

Website www.ocztechnology.com

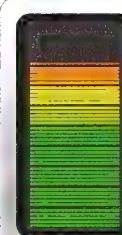
Specifications 3x 2GB kit; DDR3-2000; 7-8-7-20; 1.65v; 240-pin DIMM; Non-ECC Unbuffered DDR3

If you've heard of enthusiast memory, odds are very high that you've also heard of OCZ. The company pumps out many kits of memory, but the one we're looking at today is its very best. It's six whole gigabytes of 2000MHz 7-8-7-20 1T memory, running at a hugely fast frequency but also keeping really nice timings. If the speed didn't give it away, this is a DDR3 kit with three sticks (2GB per stick) intended for use with Core i7 systems. Called the Blade for more than just a cool name, these sticks are literally

the cutting edge in memory – though expect to pay almost six hundred dollars for them. What you get for your money is incredibly tempting however; and certainly will give you cause to think heavily about them first.

Sixteen memory chips sit on black PCB, complete with a large black heatsink. It's a strangely shaped one, completely flat on one side of the stick but curved on the other. Solid aluminium with grooves for added surface area keeps the sticks stable, but it did get noticeably warm with no airflow. When we got to overclocking them they didn't take too well to large amounts of increased frequency (already being rather fast), but gladly accepted low latency settings of 5-6-5-18 at a low voltage of 1.68V. Strangely this gave us a faster result in the memory-dependant PiFast, but lower everywhere else – including the Everest 5.01 memory latency test.

Tweaking these sticks to be slightly faster than the stock 2000MHz by adding frequency is the best bet for the Blades, but the main caveat here seems to be the lack of XMP for those who need it and are deathly afraid of evil BIOS screens. That's not bad though – anyone who knows what they're doing will be happy with this kit. **JR**



Overall
Expensive, but slices through benchmarks.

81%

i965 @ 142QPI (3.4GHz)	2000MHz; 7-8-7-20 (1T); 1.65V - Stock	1418MHz; 5-6-5-18 (1T); 1.68V
Hexus PiFast	24.66s	23.91s
wPrime 32M 8x	7.187s	7.270s
Everest Read	20083 MB/s	16872MB/s
Everest Write	15950 MB/s	13196 MB/s
Everest Latency	41.3 ns	45.8ns

OCZ Agility 120GB SSD

An agile little drive, or is it left behind?

Street Price \$489 Supplier OCZ

Website www.ocztechnology.com

Specifications 128GB (119 formatted); 64MB cache; 2.5in form factor; SATA2.0 3Gb/s

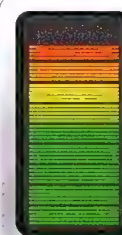
A good, reliable primary drive should be something that every hardcore builder invests in – while traditional hard drives are great and cheap for storing movies and other surreptitious things you really want something fast for your Operating System, and ideally your games too. SSDs are finally getting to the point where it's not the biggest leap to consider getting one, and this OCZ Agility is OCZ's latest budget SSD that reckons it's got the speed you need and the space you want.

Well it definitely does have a decent amount of space, with 119GB free when formatted. This is plenty for an operating system and your favourite games, but not only is it nice and roomy, it also has a very good average read speed of 219.7MB/s. That's not the fastest we've seen, but it is incredibly stable. Burst speeds were comparatively less impressive at

186.9MB/s, though write speeds got a great boost from the 64MB of cache and hit roughly 200MB/s when copying the Crysis install file. Even Program Files copied at an average write of 96.7MB/s, and it just felt faster than most other drives we've looked at.

Silence is the order of the day with an SSD, and this one manages that as well as only getting slightly warm under heavy load. As there have been many rumblings about SSD performance dropping by large chunks when the drive is full, we filled it to bursting (only 2MB left!) and re-ran the average read tests with a result of 202.0MB/s. This is a loss of only 17.4MB/s, so is hardly noticeable in the greater scheme of things.

While the Agility might not be as cheap as some of the competing offerings (such as G.Skill's drive that we're yet to look at), it does offer very good performance at a nice price. **JR**



Overall
Another solid offer from OCZ.

92%

Zalman CNPS10X Extreme

No more flower power, man.

Street Price \$98 Supplier Altech
Website www.altech.com.au

Specifications Tower heatsink, 10 heatpipes, aluminium fins, 120mm fan included

Gallery www.atomicmpc.com.au/?149046

Zalman was once the king of heatsink design, intricately weaving heatpipes and polished copper fins around one another to create something closer to art than pure heatsink. Now though it appears the company's finally given up on that legacy, moving towards a design that echoes most other designs out there – the tower. The reasons for this are pretty simple, as a direct heat path is quickest and therefore coolest (not to mention manufacturing is easier), but it's still a shame to see the change.

What we have here is pretty darn solid, with a polished nickel-plated copper base that has a rough texture but is otherwise flat. Five heatpipes are sandwiched here

by another piece of metal, and the pipes are soldered to ensure very good thermal contact. The heatpipes are bent into a rough U-shape, which curves out of the base and rises upwards through a series of nickel-plated aluminium fins, which are spaced quite well throughout. This design makes sense and under use was pretty good, with heat felt evenly over all the fins.

The top is capped with a black plastic sheath that also extends down the front face of the heatsink and doubles as the holster for the 120mm blue LED fan. There's a little plastic slug called a PWM Mate on the top that can control the speed of the fan from three preset levels, or manually, which can be completely removed and used with any fan thanks to an included cable. Zalman includes mounting gear for all popular sockets, and a little syringe of its own Thermal Grease.

Performance was lagging behind the Aywun A1-V8 from last Issue in all but overclocked



with high fanspeed – but the Zalman comes with twice the price attached. If you like the looks then this is a solid choice, otherwise grab the A1-V8 or a TRUE. **JR**

Zalman CNPS10X Extreme

	Load FanLow	Idle FanLow	Load FanHigh	Idle FanHigh
3.2GHz, 1.2V	56	35	49	33
3.6GHz, 1.35V	65	37	59	35

Overall

Nice performance, but pricey.

81%

Thermalright HR-03 GTX

Bigger, badder, better.

Street Price \$80 Supplier Thermalright
Website www.thermalright.com

Specifications Curled heatsink, 5 heatpipes, aluminium fins, 120mm fan compatible

Thermalright has long been entrusted with cooling our CPUs, producing some of the finest heatsinks in the business and even taking top spot with its ever-popular TRUE. Something the company also does, but that is less common, is GPU cooling. We asked for Thermalright's bestest model and got the HR-03 GTX – and boy is it something.

Compatibility ranges from the GTX260 to the GTX280/285, and included in the box is every heatsink you'll need along with a tube of thermal paste and installation instructions.

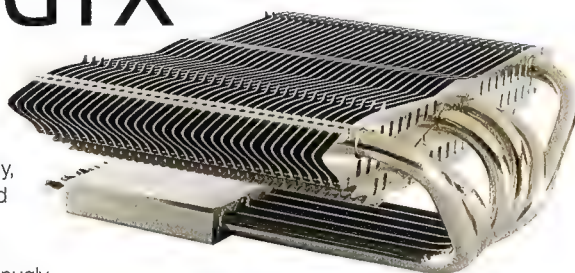
Thermalright HR-03 GTX

Leadtek GTX285	Load	Idle
Stock Cooler	72	45
Thermalright HR-03 GTX	50	35

The first step is to remove the stock cooler (we chose a Leadtek GTX285) and clean the card completely, before identifying the heatsinks needed with the manual. This is probably the trickiest part, as some of the pictures are not quite clear, but everything fits snugly and exactly where it was supposed to. The adhesive used on the ramsinks was not incredibly strong until some heat had been applied under load, so we had to be careful not to bump them off.

The main heatsink consists of a large nickel base that sandwiches six nickel-plated heatpipes, which run up the card vertically before a U-turn, and come down through a series of aluminium fins. There's a large spacing between these fins to allow for low-pressured fans to be used, and while it is compatible with a 120mm fan there is none included in the box.

Performance, compared to the stock heatsink was great, with a drop of ten degrees at idle and a huge 22 degrees at load. Without a fan the card crept up to 74 degrees at idle,



too hot to run any benchmarks, but even a quiet 120mm fan should be more than enough. Unfortunately the final size is about five expansion slots – though this is rewarded with the best air cooling you can buy. Short of watercooling, there's nothing better. **JR**

Overall

A solid design, light on features, slightly high price.

88%

Aywun A1-V6

Two cylinders dropped, but still impressive.

Street Price \$42 Supplier Altech
Website www.altech.com.au

Specifications Tower heatsink, 6 heatpipes, aluminium fins, 92mm fan included

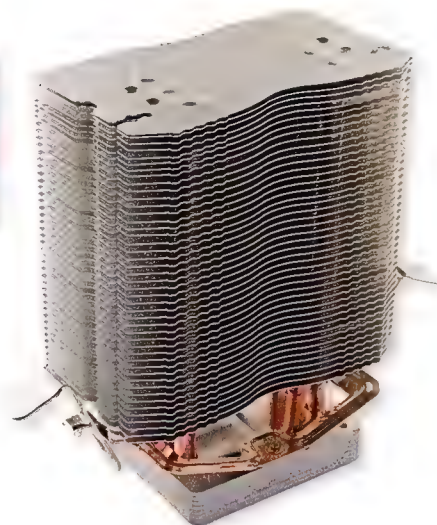
When we looked at the first Aywun A1-V8 heatsink last issue (103, page 47) we were impressed; and Aywun has managed to knock our socks off again with its midgetesque A1-V6. It's much smaller than most coolers out there, with a height of only 133mm, but that doesn't mean it's a terrible performer.

The base of this heatsink is formed from six sheets of aluminium, each with a cutout for three heatpipes. They hold the pipes in place, placing them directly against the IHS on the CPU to take the heat away quickly. Bent into the same U shape that we've seen in every tower heatsink this gives an effective six paths for heat to travel. They're spaced quite well, and head up into the series of aluminium fins

to distribute the heat – there were no areas that felt cooler and every piece of metal was being used utilised in the process.

Shaped almost like a D from above, the Aywun comes with a 92mm LED fan mounted to the straight side of the cooler to blow air through, and also comes with a variable rheostat controller that gives direct fanspeed manipulation. A noise of 51.6dBA at low is impressively quiet, though the high speed makes an annoying 70.1dBA. Mounting this heatsink was a breeze; with a bracket installed on the mobo and secured with pins the heatsink is simply clipped onto the bracket, forming an incredibly solid and even pressure. Compatibility covers 1366, 775 and all AMD sockets.

The performance for such a small 'sink was great, passing our torture tests at stock on low fanspeed easily – and even managing



to pass the same tests while overclocked at high fanspeed! Considering the normal TDP is 130W for the CPU this is a huge amount while overclocked; and for the price this heatsink can't be ignored. **JR**

Aywun A1-V6

	Load FanLow	Idle FanLow	Load FanHigh	Idle FanHigh
3.2GHz, 1.2V	64	41	56	37
3.6GHz, 1.35V	82 – Fail @ 1:56	43	73	42



Razer Mamba wireless

A stylish alternative to cabled mousing.

Street Price \$190 Supplier AudionMM
Website www.audion-mm.com

We have a love/hate relationship with Razer products here at Atomic. On the one hand, there's the tactile pleasure of rubberised surfaces and sleek curves, and yet on the other there's a distinct lack of... well, performance. And then along comes the Mamba wireless mouse to blow that away!

The Mamba is very much a Razer design. Present are the same array of curves and black rubber that'd turn a fetishist's eye; gone is not only the cable, but also the usual symmetry of Razer gear. The Mamba has a long deep curve on the left-hand side, and a shallower shorter curve on the right – combined with inset rubber grips, this was a revelation to pick up and use for the first time. Our fingers fitted near-perfectly around the mouse, neither grasping for purchase or feeling cramped. The high curving upper surface also fits hands a little more snugly.

When plugged in and powered up on its

charging stand, the Mamba really is a work of art.

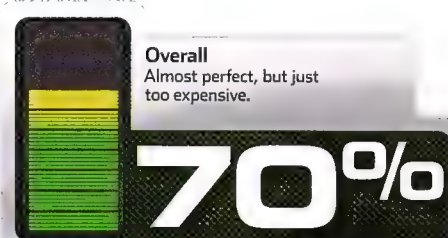
The Mamba continues to score points with its base charger, too, a magnetised plinth with a sturdy cloth-wrapped cord. Powered up, the base is underlit a cool blue. The cable running into the base can also be detached to power the mouse directly. It's not as elegant a solution as the MS X8, but it works.

The true test of a mouse, however, is in game performance, and in our usual CoD4 testing we saw solid reliability – the centrally mounted laser sensor offers accurate tracking, the buttons (with the exception of the DPI switch) are responsive and well-placed, and the mouse-wheel is grippy without feeling heavy. In use, though, we did discover that the thumb groove is perhaps a touch too deep. It was more or less comfy for tiny, Editor-sized hands, but larger, Tech-writer-sized hands had to arch the thumb a little uncomfortable to grip the mouse.

The Mamba is a truly solid effort that would give our preferred mouse – Microsoft's X8 – a run for its money were it not for one important



point: price. The Mamba will set you back nearly \$200 for the privilege; sure, you might get a work of art, but the Mona Lisa never helped anyone frag. **DH**



Creative Aurvana Air

Flextastic titanium audiolity.

Street Price RRP\$299 **Supplier** Creative
Website <http://au.creative.com/>

Specifications earbuds; behind-ear wire loop; 1.2m cable length; 15.5mm neodymium drivers; 32ohm resistance; 3.5mm jack.

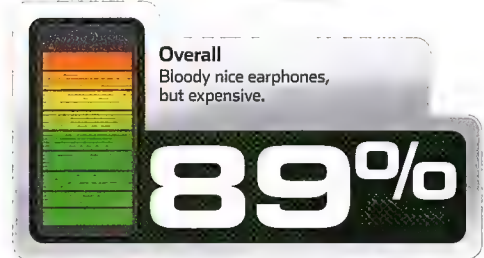
We usually prefer huge gaming headsets around Atomic but when Creative showed us its Aurvanas we slipped them on instead and gave them a run-through, with results that might almost justify that positively huge pricetag. They're ultra-premium earphones, complete with a leather carry case and packaging that's more display podium than functional box.

A smooth rubber-coated cable about two-thirds of a tech writer (1.2m) has a simple 3.5mm gold-plated headphone jack. It's got a solid plastic connector to stop the cable from being tugged on as much when removing it from sockets, but the cable still feels pretty weakly connected. Down the other end it splits into two separate cables for each channel of audio, each equal in length, from another small plastic lump.

The earbuds themselves are the usual size, but are silver with a brushed steel mount and small arm – this attaches to a shaped tube with

wire loop. Slipping on your ear, it feels really comfortable when worn and is so light it is practically unnoticeable under use. It's also incredibly light thanks to the nickel-titanium alloy used, and springs back into place if bent. The drivers in these puppies are 15.5mm Neodymium with a standard freq response.

Sound reproduction is incredibly clear for earbuds, which are open to most external noise by design, handling gentle guitar twangs as easily as the hearty bassline of MC Hammer's song of choice. The treble can kick in a little too enthusiastically at times, but for the most part remains perfectly fine. These are great for music, but also even managed to serve well for gaming on the go – and you can even run with them! The wire loops were absolutely perfect, and they never fell off. If you've got to have the best in earbuds this is it; but be prepared to hand over barrelfuls of gold bullion for the privilege.  **JR**



Realforce 103U-UB

Strong enough to kill a man.

Street Price TBC **Supplier** Topre Corporation
Website www.topre.co.jp/e_index.html

With a name like Realforce you'd half expect a multitude of lights, switches and dials all over this keyboard – but instead you'll find something so minimalistic it's actually pretty cool. Sheathed in a matte black plastic, even the keys are treated to black lettering that can make them difficult to read from any position not directly above the keyboard. It's the kind of thing you'd see a hacker use – but this one can be used for so much more.

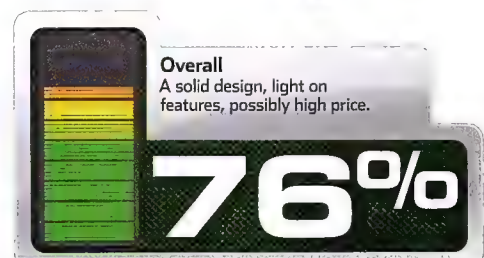
Harking back to the old mechanically driven IBM keyboards of old, the Realforce is built around a hybrid rubber dome (found in most cheaper keyboards) and spring (more expensive) design. This means that each key theoretically should be whisper quiet, and will be incredibly sturdy. Well they got the latter right but as we tapped away on this for the first time we were surprised at the amount of noise generated.

Key action is smoother than your average

porno flick, sliding in and out with almost no effort at all to rise back up pretty quickly.

The shift key was a little slow at returning (or we were typing too fast), meaning that we got some DOuble-Capped keys for a small while until we adjusted. Also reminiscent of ye olde keyboards is the weight; at about 1.4kg this feels like a solid piece of kit that will last through just about anything.

A built-in cabling channel underneath the board can run the cable to the left or right edge for neatness, and two sturdy plastic feet raise it to a comfortable typing level. It's got almost no bells or whistles save for USB, but will last for years to come. The only caveat we have here is price; at \$US228 overseas this is gonna be expensive when it makes it to the local market. For purists however there is nothing better.  **JR**



Mother Mayhem

James Gorbold and Anthony Leather
bench the best boards to find the
ultimate in silicon heaven.

board

It wasn't all that long ago that if you wanted to build a high-performance PC the only sensible option was some sort of Core 2 CPU and a LGA775 motherboard. However, after several months of development the market is finally beginning to change – manufacturers are beginning to churn out LGA1366 motherboards for Core i7 CPUs while a torrent of Socket AM3 motherboards also fly off store shelves.

Probably the best news for enthusiasts out of all this is that after all the problems the industry had building a AM2 or AM2+ motherboard that was actually decent, many of the AM3 boards are genuinely brilliant. That doesn't mean you should simply go out and buy the first Socket AM3 motherboard you lay your eyes on – but luckily we've benchmarked and measured significant differences between the various models. What it does mean though is that the curse of underperforming Phenoms and explosive Socket AM2+ motherboards seems to have finally been put to rest.

If you're looking for a motherboard for a Core i7 system then now is also a good time to look. After the first batch of ridiculously priced models, many manufacturers have started to release cheaper cut-down versions. Even more encouragingly, ASUS and MSI have both released micro-ATX motherboards that amazingly lack very few of the features their larger ATX brethren boast.

With so many exciting new motherboards on offer, until Intel releases its next-gen P55 boards later this year, now is a great time to upgrade your new motherboard.

HOW WE TESTED

While it's comparatively easy and quick to test a graphics card or CPU, it's far more time-consuming to test a motherboard. Factors such as the layout of a BIOS menu, cooling of all the major components on the board (such as Northbridge/Southbridge chips), the quality of the power phases and the quality of components such as capacitors chosen all add up to give one board an edge over the others. This is why we take motherboard design so seriously; after all, a well designed motherboard will allow you to overclock your CPU well beyond its stock frequency. Who doesn't like free speed?

Before benchmarking we update the BIOS to the latest version and use the latest chipset and graphics card drivers. We then benchmark each motherboard at its BIOS defaults using the 2007 version of our Media Benchmarks, and Crysis at 1,680 x 1,050 with 2x AA and 'high' detail settings. This tells us how fast each motherboard

is at its stock out-of-the box settings.

Once these tests are complete we try to find the maximum stable bus speed each motherboard will support. To ensure that the motherboard, and not the CPU or RAM, are the limiting factor in this test we drop the CPU multiplier and RAM strap/divider to the minimum allowable setting and then proceed to raise the

we do not publish any benchmark results at these settings, instead we graph the maximum stable QPI/HTT frequency.

Once we know what the maximum stable QPI/HTT frequency of each motherboard, we then try to find out if the motherboard can max out our test CPUs at their default bus multiplier. This test does not always produce the same

...we try to find the maximum stable bus speed each motherboard will support.

QPI/HTT, depending on whether we're testing a LGA1366 or AM3 motherboard. To check the motherboard's stability when overclocked we leave them running the blend stress test in Prime95 for several minutes. Because the CPU and RAM are running at such a low frequency

result as the first overclocking test, because it puts the voltage circuits on the motherboard under additional strain, but is well worth carrying out. For example, we know that the maximum frequency our LGA1366 Core i7-920 test CPU will overclock to is 4GHz, which requires a QPI

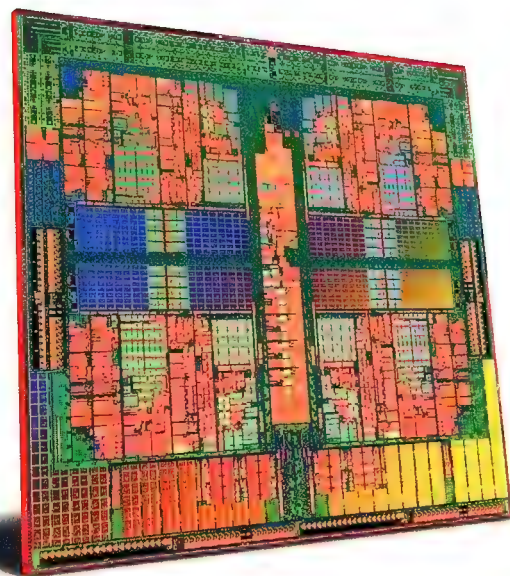
AM3 Feature table

	ASUS M4A79T Deluxe	ASUS Crosshair III Formula	DFI Lanparty DK 790FXB-M3H5	GIGABYTE GA-MA770T-UD3P
Price	\$319	\$459	\$219	\$130
Supplier	ASUS	ASUS	Altech	GIGABYTE
Manufacturer	www.asus.com.au	www.asus.com.au	www.altech.com.au	www.giga-byte.com.au
Chipset				
Chipset	AMD 790FX	AMD 790FX	AMD 790FX	AMD 770
RAID	AMD SB750	AMD SB750	AMD SB750	AMD SB710
Audio	Realtek ALC1200	ASUS SupremeFX	Realtek ALC885	Realtek ALC888
Ports				
PCI	2	1	3	2
PCI-E slots	Four 16x	Two 16x, Three 1x	Three 16x	One 16x, Four 1x
DIMM	4 x DDR3	4 x DDR3	4 x DDR3	4 x DDR3
SATA II / eSATA	5 (RAID capable) / 1	5 (RAID capable) / 1	6 (RAID capable) / 0	6 (RAID capable) / 0
Audio	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out
Cooling				
Northbridge	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink
Southbridge	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink	Heatsink
VRMs	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	N
Fan headers	4	7	6	4
Bundled extras				
Cables	EIDE, FDD, 5 x S-ATA	EIDE, 4 x S-ATA	Rounded EIDE, 4 x S-ATA	EIDE, 2 x S-ATA
Miscellaneous	CrossFire bridge	LCD Poster	CrossFire bridge	N

of 200MHz. In contrast, we know that the highest frequency our Socket AM3 Phenom II X3 720 Black Edition test CPU will run at is 3.74GHz, which requires a HTT speed of 267MHz. As not all motherboards are capable of maxing out our test CPUs, this test often reveals significant performance differences between motherboards, which is why you'll find the benchmark results from this test alongside the stock speed benchmark results on the graphs pages.

All the LGA1366 motherboards were tested using a Core i7-920, 6GB of Corsair DDR3 1333MHz, a 1TB Seagate Barracuda 7200.11 hard disk and a Zotac GeForce GTX 260 AMP! Edition graphics card running Windows Vista 64-bit. The Socket AM3 motherboards were tested with the same components, apart from the RAM which was replaced with 4GB of Corsair XMS3 DDR3 1600MHz.

We also looked at the features of each motherboard, such as how many SATA II ports there are, the quality of the onboard sound, and the actual component layout. Motherboards with widely spaced PCI-E slots are awarded more features points because it will be easier to cool graphics cards on these motherboards. We also paid close attention to the CrossFire and SLI motherboards to make sure if you fit multiple dual-slot graphics cards you can still use the PCI slots. Points were also awarded for how well the chipset, VRMs and Southbridge are cooled and how intuitive and user-friendly the BIOS is to use when overclocking. We then calculated the overall score for each motherboard by a weighted average of the performance (stock and overclocked), maximum stable QPI/HTT, features and value for money.



AM3 Feature table

	GIGABYTE GA-MA790FX-UD5P	GIGABYTE GA-MA790XT-UD4P	MSI 790FX-GD70	MSI 790GX-G65
Price	\$260	\$210	\$300	\$225
Supplier	GIGABYTE	GIGABYTE	MSI	MSI
Manufacturer	www.giga-byte.com.au	www.giga-byte.com.au	www.msicomputer.com.au	www.msicomputer.com.au
Chipset				
Chipset	AMD 790FX	AMD 790X	AMD 790FX	AMD 790GX w/ HD3300 GPU
RAID	AMD SB750, JMicron JM322	AMD SB750, JMicron JM322	AMD SB750, JMicron JMB362	AMD SB750
Audio	Realtek ALC889A	Realtek ALC889A	Realtek ALC889	Realtek ALC889
Ports				
PCI	2	2	2	2
PCI-E slots	Two 16x, Three 1x	Two 16x, Three 1x	Four 16x, One 1x	Two 16x, Two 1x
DIMM	4 x DDR3	4 x DDR3	4 x DDR3	4 x DDR3
SATA II / eSATA	10 (RAID capable) / 0	8 (RAID capable) / 0	8 (RAID capable) / 1	5 (RAID capable) / 1 (RAID capable)
Audio	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, optical S/PDIF out
Cooling				
Northbridge	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe
Southbridge	Heatsink and heatpipe	Heatsink	Heatsink and heatpipe	Heatsink
VRMs	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe
Fan headers	5	4	4	4
Bundled extras				
Cables		EIDE, FDD, 4 x S-ATA	EIDE, FDD, 4 x S-ATA	EIDE, 4 x S-ATA
Miscellaneous		N	CrossFire bridge	CrossFire bridge

DFI Lanparty DK 790FXB-M3H5

Quirky, slow and a poor overclocker

Street Price \$219

Specifications Socket AM3; AMD 790FX chipset; ATX form factor; 3x PCIe x16; 3x PCI; 1x EIDE; 1x FDD; 4x SATA

DFI's Lanparty motherboards used to be renowned as fantastic overclockers, although they were always a little quirky. Unfortunately, recent models have proven particularly quirky, supporting a very limited number of memory straps amongst other issues.

The forgettable named DK 790FXB-M3H5 is based on the ageing 790FX chipset, which means it has three 16x PCIe slots. You can run up to three graphics cards in CrossFire, but the last slot only provides four lanes of PCIe bandwidth – which will severely limit performance. There is also a generous three PCI slots plus six RAID-capable SATA ports, which have been helpfully positioned parallel with the PCB to aid tidy cabling.

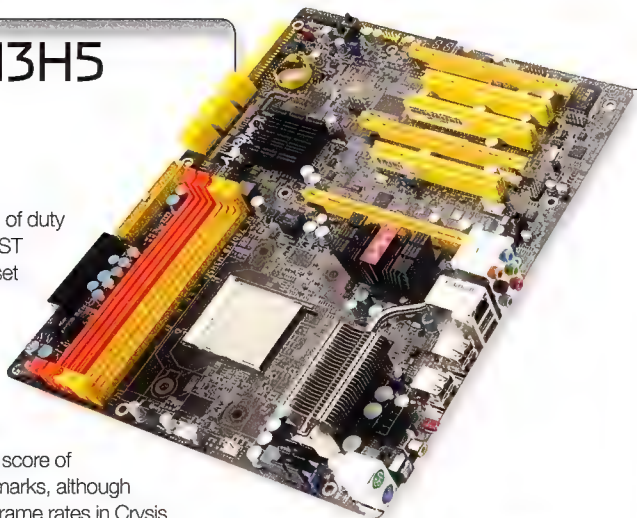
The chipset and VRMs share a linked heatsink and heatpipe while the Southbridge has its own tiny heatsink. Despite the wealth of slots, the PCB layout is very good, with all the components free from obstructions.

Above and beyond the call of duty you'll find a useful LED POST screen, and power and reset switches integrated onto the PCB.

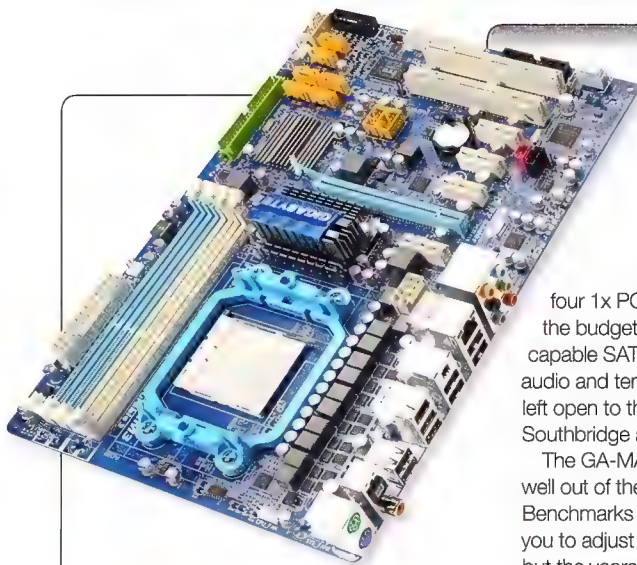
Out of the box the DK 790FXB-M3H5 was the slowest Socket AM3 motherboard on test, with a poor overall score of 1,001 in our Media Benchmarks, although its minimum and average frame rates in Crysis were far more respectable. Although the BIOS is extremely comprehensive, it's not intuitive to use, with multiple options for some settings while still being very laggy.

After extensive tweaking we found the DK 790FXB-M3H5 would not run Prime95 with the HTT set any higher than 240MHz – a very disappointing result. The DK 790FXB-M3H5 would not POST at anything other than the lowest memory strap of 1:2, which meant that the RAM was only clocked at 960MHz – very slow indeed.

Although the DK 790FXB-M3H5 is visually



distinctive and has plenty of well-spaced expansion slots, its laggy, quirky BIOS and poor performance mean we can't recommend it.



GIGABYTE GA-MA770T-UD3P

A brilliant budget overclocker.

Street Price \$130

Specifications Socket AM3; AMD 770 chipset; ATX form factor; 1x PCIe x16; 4 x PCIe x1; 2x PCI; 1x EIDE; 1x FDD; 6x SATA

four 1x PCIe slots and two PCI slots. Despite the budget credentials there are six RAID-capable SATA II ports, 8-channel integrated audio and ten USB 2 ports. The VRMs are left open to the breeze but the chipset and Southbridge are fitted with small heatsinks.

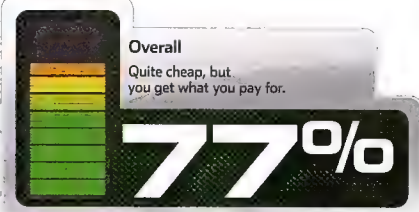
The GA-MA770T-UD3P performed very well out of the box, with an overall Media Benchmarks score of 1,054. The BIOS allows you to adjust the voltage of many components, but the vcore and CPU-NB can only be adjusted in increments; you can't simply select an absolute value as you can with the other components.

This isn't the best way to organise a BIOS, but with CPU multiplier lowered to 4x we got the board running Prime95 with a HTT of 270MHz. This required raising the vCore by 225mV, the CPU-NB by 200mV, setting the chipset to 1.5V and the Southbridge to 1.32V. Despite the lack of heatsinks, the VRMs were only lukewarm when overclocked, so the GA-MA770T-UD3P

would appear to be able to easily cope with lots of extra voltage.

With the CPU multiplier returned to its 14x default, the GA-MA770T-UD3P proved easily able to max out our test CPU with a 267MHz HTT. In this configuration, its overall Media Benchmarks score rose to 1,308, a good, but not record-breaking result.

The GA-MA770T-UD3P is a very cheap, formidable overclocker. If you're on a tight budget and fancy overclocking your CPU to the edge the GA-MA770T-UD3P is well worth investigating.



Up until now we've seen very few motherboards based on the AMD 770 chipset, probably because, as an entry-level chipset it's not really designed with enthusiasts in mind.

GIGABYTE has a history of producing excellent motherboards based on entry-level chipsets. As the AMD 770 chipset only supports a limited number of PCIe lanes the GA-MA770T-UD3P has a single 16x PCIe slot,

GIGABYTE GA-MA790FXT-UD5P

Ain't bad, but not amazing either.

Street Price \$260

Specifications Socket AM3; AMD 790FX chipset; ATX form factor; 2x PCIe x16; 3 x PCIe x1; 2x PCI; 1x EIDE; 1xFDD; 10x SATA

The GA-MA790FXT-UD5P might sound like the astronomical name of a distant star but it's actually the name of GIGABYTE's high-end-ish AM3 mobo, with a suitably high price-tag to match.

This board is based on the AMD 790FX chipset, which is very much geared towards enthusiasts. However, although GIGABYTE hasn't used the four 16x PCIe slot capabilities of the chipset on the GA-MA790FXT-UD5P (it has two slots), there are some more subtle differences too.

For starters the chipset, Southbridge and VRMs are cooled by a complex array of heatsinks and heatpipes, which should help overclocking and overvolting. The GA-MA790FXT-UD5P also has ten RAID-capable SATA II ports. In addition to the two 16x PCIe slots you'll also find two PCI slots and three 1x PCIe slots, although one of the latter can only fit a teensy little card due to heatsink clearance.

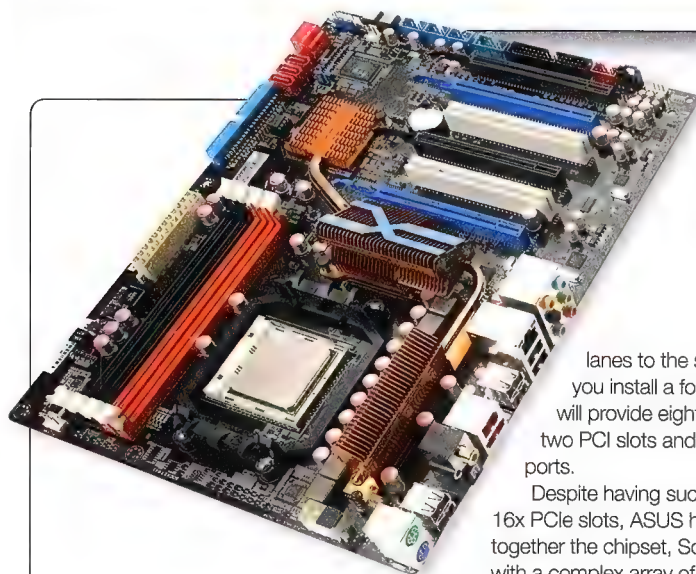
Out of the box the BIOS does a good job of making the most of the hardware, giving a respectable overall Media Benchmarks score of 1,044. When it comes to overclocking, the BIOS presents a very comprehensive range of voltage and frequency tweaks, although you have to adjust the voltage of most components in increments, rather than entering the absolute value you want.

By lowering the multiplier of our test CPU to 4x, we were able to run Prime95 with a HTT of 275MHz – making it one of the better overclockers. This required increasing the vcore by 225mV, the CPU-NB by 200mV and the SB and HT by 200mV. When we returned the CPU to its 14x default the GA-MA790FXT-UD5P was easily able to max out the processor with an HTT of 267MHz. In this configuration the system achieved an above average Media Benchmarks



score of 1,330.

This board is a decent choice; but there are definitely better boards out there. 



ASUS M4A79T Deluxe

PCIe a-plenty, but OC limited.

Street Price \$319

Specifications Socket AM3; AMD 790FX chipset; ATX form factor; 4x PCIe x16; 2x PCI; 1x EIDE; 1xFDD; 5x SATA

The M4A79T Deluxe was one of the very first Socket AM3 motherboards to appear on the market and has already dropped in price by a considerable amount.

As the Deluxe is based on the ageing AMD 790FX chipset, which supports more PCIe lanes than you can poke a stick at, it's equipped with four 16x PCIe slots. With up to three graphics cards installed, the first slot provides 16 lanes of bandwidth, and eight

lanes to the second and third slot. If you install a fourth card, all four slots will provide eight lanes. There are also two PCI slots and five RAID-capable SATA ports.

Despite having such a large number of 16x PCIe slots, ASUS has still managed to link together the chipset, Southbridge and VRMs with a complex array of heatsinks and heatpipes. Despite this large cooling array the BIOS has fairly conservative maximum selectable voltages, although it's very easy and intuitive to use.

Out of the box the M4A79T Deluxe achieved a high overall score of 1,057 in our Media Benchmarks, second only to the MSI 790FX-GD70. Initially, the M4A79T Deluxe appeared to have excellent overclocking credentials, as with the CPU multiplier lowered to 5x we could run Prime95 with the HTT raised to a dizzying 280MHz. As such, we were very surprised

that the M4A79T Deluxe proved unable to benchmark stably with an HTT of 267MHz when we returned the CPU multiplier to its default of 14x – the limit of our test CPU.

Although the M4A79T Deluxe can support up to three dual-slot graphics cards plus one single-slot graphics card, its inability to max our test CPU when overclocked does raise some concerns. Given the stiff competition in the Socket AM3 motherboard market, you can do better. 



ASUS Crosshair III Formula

The first AMD ROG board hits a spot.

Street Price \$459

Specifications Socket AM3; AMD 790FX chipset; ATX form factor; 2x PCIe x16; 3x PCIe 1x; 1x PCI; 1x EIDE; 1x FDD; 5x SATA

The Crosshair III Formula is the first AMD motherboard from ASUS' premium Republic of Gamers series ever. With Socket AM3 proving a real comeback for AMD, it's good to see motherboard manufacturers designing high-end motherboards with these CPUs in mind.

Although the Crosshair III Formula is based on the AMD 790FX chipset, it's equipped with two, rather than the more-usual four 16x PCIe slots. This is a sensible decision, given that as four-card CrossFire is flakier than lead-based paint. The PCB is filled out with three 1x PCIe slots, one of which is reserved for a proprietary ASUS SupremeFX sound card. While this supports X-Fi software it does not have an X-Fi chip, and is simply the onboard chip.

The PCB is dominated by a large cooling array that links the chipset, Southbridge and VRMs together via heatpipes. The arrangement isn't entirely problem-free

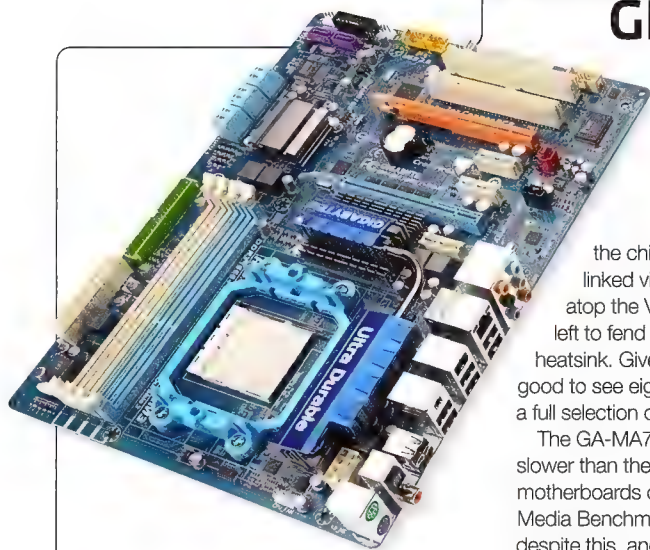
– the Southbridge is positioned so close to the primary 16x PCIe slot that it will be impossible to watercool the chip with a dual-slot graphics card installed.

Given its Republic of Gamers branding, we were pleased to see the Crosshair III Formula perform well at its default BIOS settings. Like all recent ASUS motherboards, the BIOS is very easy to use and has several save-able overclocking profiles. By lowering the CPU multiplier to 4x, boosting the vcore to 1.55V, the CPU-NB to 1.5V and the chipset to 1.51V the Crosshair III Formula would run Prime95 happily with a stunning 280MHz HTT.

This meant that when we returned the CPU multiplier to its 14x default the Crosshair III Formula could easily produce the 267MHz HTT required to max out our test CPU. Even better,



this overclock could be achieved with a lower CPU-NB voltage of 1.35V, thus reducing strain on the CPU and motherboard. It might be pricey, but this board seems worth every penny.



GIGABYTE GA-MA790XT-UD4P

One of the best overclockers in the bunch.

Street Price \$210

Specifications Socket AM3; AMD 790FX chipset; ATX form factor; 2x PCIe x16; 3x PCIe 1x; 2 PCI; 1x EIDE; 1x FDD; 8x SATA

The GA-MA790XT-UD4P sits in the middle of GIGABYTE's range of Socket AM3 motherboards and is based on the AMD 790X chipset.

As a result the board has two CrossFire compatible 16x PCIe slots, two PCI slots and three 1x PCIe slots. However, one of the 1x PCIe slots can only accommodate a smaller-length expansion card due to its proximity to

the chipset heatsink. This heatsink is linked via heatpipe to another heatsink atop the VRMs, while the Southbridge is left to fend for itself with its own separate heatsink. Given the board's decent price, it's good to see eight RAID-capable SATA ports plus a full selection of other I/O ports.

The GA-MA790XT-UD4P proved slightly slower than the other two GIGABYTE motherboards out of the box, with an overall Media Benchmarks score of 1,027. However, despite this, and the somewhat unintuitive BIOS that forces you to adjust voltages in increments rather than selecting an absolute value, the mobo proved an excellent overclocker.

With the multiplier of our test CPU lowered to its minimum of 4x, the GA-MA790XT-UD4P would run Prime95 at an incredible 285MHz, one of just two boards to reach this high frequency. This fantastic overclock was achieved by raising the vCore by 225mV, the CPU-NB by 200mV, the chipset by 300mV and the

Southbridge by 300mV.

Thanks to the excellent behaviour in our maximum HTT test we had no problem convincing it to max out our test CPU with a 14x multiplier and HTT of 267MHz. This boosted its overall Media Benchmarks score to 1,330. This overclock also provided a very welcome boost to the system's frame rates in Crysis, raising the minimum from 23fps to 32fps and the average from 31fps to 38fps.

This is definitely a board to consider when picking your next AMD mobo.



MSI 790GX-G65

Integrated graphics don't hinder this board's overclocking prowess.

Street Price \$225

Specifications Socket AM3; AMD 790GX chipset; ATX form factor; 2x PCIe x16; 2x PCIe 1x; 2 PCI; 1x EIDE; 1x FDD; 5x SATA

MSI appears to be intent on producing a Socket AM3 motherboard for everyone, while the 790GX-G65 sits in the middle of this range, priced at a very reasonable \$225.

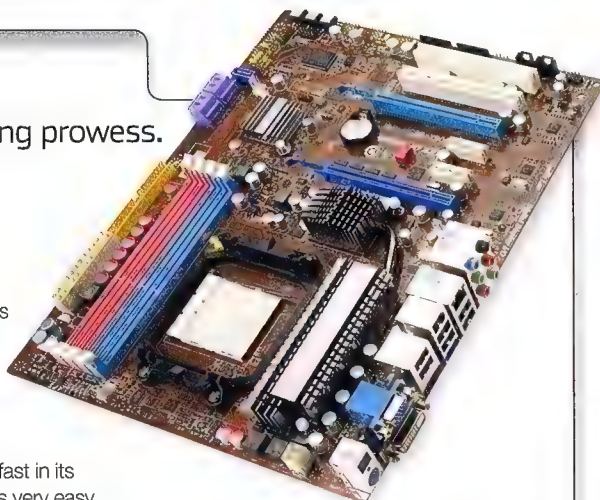
MSI has succeeded in keeping the price low because the 790GX-G65 is based on the AMD 790GX chipset. As the G in its name insinuates, this chipset sports an integrated GPU – the Radeon HD3300. However, although the GPU is provided with D-SUB, DVI and HDMI outputs, it's only really powerful enough for basic Windows apps and movies, not playing games. The 790GX-G65 has two CrossFire-compatible 16x PCI-E slots plus a pair of 1x PCI-E slots and pair of PCI slots.

The PCB layout is clear of obstructions, thanks to the S-ATA II ports being mounted parallel with the PCB for easy cabling. The chipset and VRMs are cooled by separate heatsinks that are linked together with a

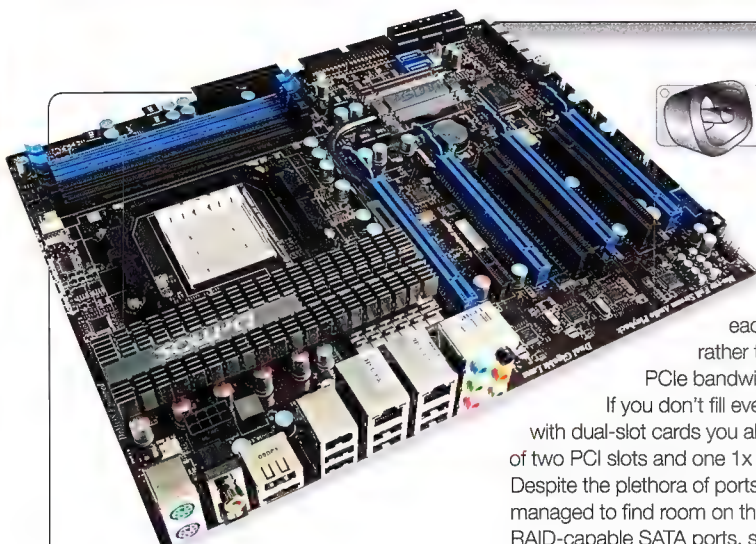
heatpipe, while the Southbridge has its own separate smaller heatsink. Rather surprisingly, the 790GX-G65 only has five RAID-capable SATA ports, odd considering the price.

The 790GX-G65 isn't particularly fast in its default configuration, but the BIOS is very easy to use, thanks to the ability to set every voltage as an absolute value, rather than changing it in increments. There are also four saveable BIOS profiles. With the CPU multiplier dropped to 5x, the vCore set to 1.549V, the CPU-NB to 1.505V, the chipset to 1.304V, the HT to 1.303V and the Southbridge to 1.322V the mobo would run Prime95 with a 275MHz HTT.

Unsurprisingly therefore, we were easily able to max out our test CPU with a 14x multiplier and 267MHz HTT at the same voltage settings. This boosted its overall Media Benchmarks score from 1,029 to 1,364.



The 790GX-G65 is one of the fastest and most overclockable Socket AM3 motherboards we've seen, so given the reasonable price it's a great purchase.



MSI 790FX-GD70

Cream of the AM3 crop.

Street Price \$300

Specifications Socket AM3; AMD 790FX chipset; ATX form factor; 4x PCIe x16; 1x PCIe 1x; 2 PCI; 1x EIDE; 1x FDD; 8x SATA

After a couple of quiet years during which MSI seemed more focused on making colourful paperweights than motherboards, the company has returned to form in style. As its name makes patently clear, the 790FX-GD70 is based on the AMD 790FX chipset, but unlike some manufacturers MSI has used the full capabilities of the chipset by fitting four 16x PCIe slots.

If you do plump for four graphics cards, bear in mind that all four slots slow down,

each providing eight rather than 16 lanes of PCIe bandwidth.

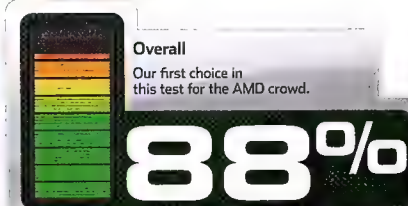
If you don't fill every 16x PCIe slot with dual-slot cards you also have a selection of two PCI slots and one 1x PCIe slot to fill. Despite the plethora of ports, MSI has still managed to find room on the PCB for eight RAID-capable SATA ports, six of which are mounted parallel with the PCB to aid tidy wiring.

Unlike on most motherboards, the chipset and VRMs on the 790FX-GD70 are right next to each other. This means they share one behemoth heatsink, which is linked to the Southbridge via a heatpipe. It's hard for us to judge whether this is superior to the more traditional design of three separate heatsinks, but as you'll see, the 790FX-GD70 is a fantastic overclocker.

At its default BIOS settings, the 790FX-GD70 proved the fastest Socket AM3 motherboard in

the Labs tests with an unimpeachable overall score of 1,074 in our Media Benchmarks. It also posted the fastest frame rates in Crysis, with a minimum of 28fps and average of 35fps. The BIOS is very straightforward and intuitive as you can adjust the voltage of all the various components by setting the absolute value, rather than adjusting them in increments.

When we dropped the multiplier of our test CPU to its minimum 4x the 790FX-GD70 would happily run Prime95 stably with an HTT of 285MHz.



Standard

Overclocked

GIMP Image editing



Multitasking



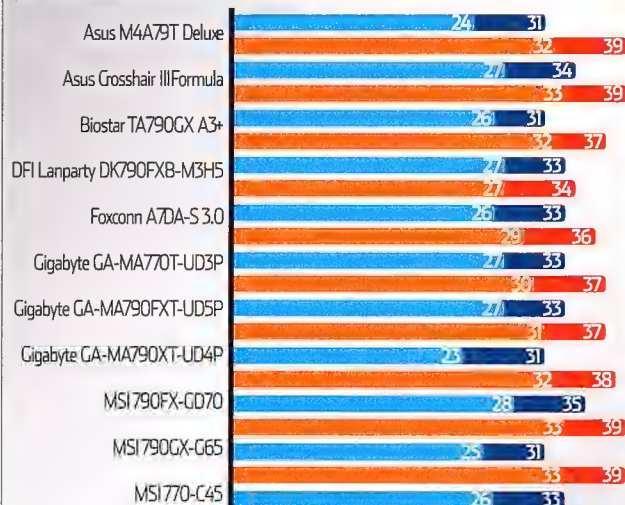
Handbrake H.264 video encoding



Overall



Crysis 1680x1050 2xAA "high"



Maximum stable HTT



■ Min ■ Avg ■ O/C min ■ O/C avg

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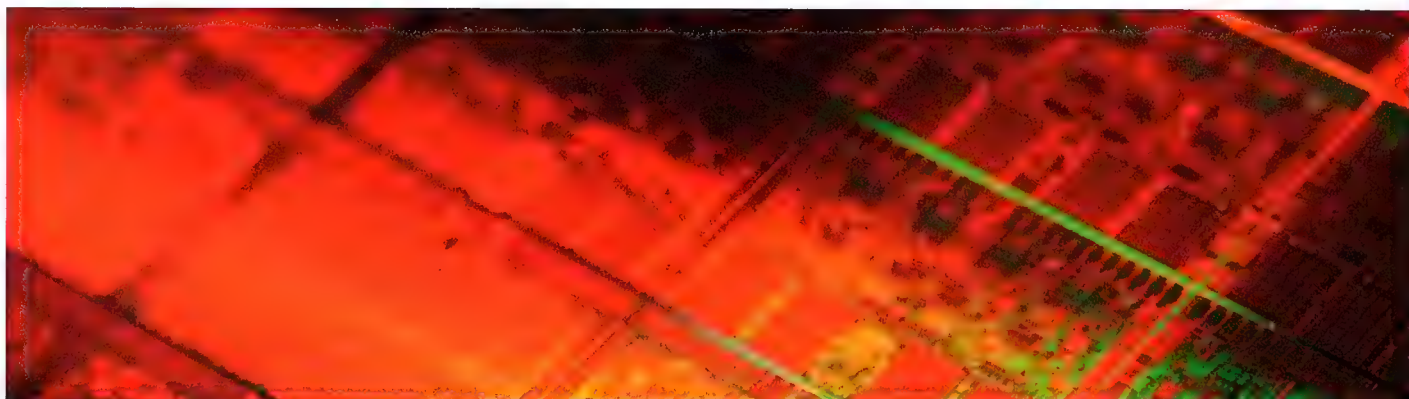
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Socket 1366 Feature table

	ASUS P6T Deluxe V2	ASUS P6T SE	ASUS Rampage II Gene	DFI Lanparty UT X58-T3eH8	Foxconn Flaming Blade
Price	\$437	\$297	\$472	\$440	\$250
Supplier	ASUS	ASUS	ASUS	Altech	Foxconn
Manufacturer	www.asus.com.au	www.asus.com.au	www.asus.com.au	www.altech.com.au	www.foxconn.com
Chipset					
RAID	Intel X58	Intel X58	Intel X58	Intel X58	Intel X58
Audio	Intel ICH10R	Intel ICH10R	Intel ICH10R	Intel ICH10R, JMicron JM363	Intel ICH10R, JMicron JM363
Ports	ADI 2000B	Realtek ALC1200	Asus SupremeFX	Realtek ALC889	Realtek ALC888
PCI					
PCI-E graphics	2	2	1	2	2
DIMM	Three 16x, One 4x	Three 16x, One 1x	Two 16x, One 4x	Three 16x, One 4x	Two 16x, One 4x, One 1x
SATA II / eSATA	6 x DDR3	6 x DDR3	6 x DDR3	6 x DDR3	3 x DDR3
Audio	6 (RAID capable) / 1	6 (RAID capable) / 1	6 (RAID capable) / 2	8 (RAID capable) / 0	6 (RAID capable) / 2 (RAID capable)
Cooling	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out, coaxial S/PDIF in	4 x surround audio out, optical S/PDIF out
Northbridge					
Southbridge	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe
VRMs	Heatsink and heatpipe	Heatsink	Heatsink	Heatsink	Heatsink and heatpipe
Fan headers	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe
Bundled extras	4	4	5	5	3
Cables	EIDE, 6 x S-ATA	EIDE, 4 x S-ATA	EIDE, 2 x S-ATA	Rounded EIDE, rounded FDD, 4 x S-ATA	EIDE, 4 x S-ATA
Miscellaneous	SLI bridge	N	LCD Poster, SLI bridge	CrossFire bridge, SLI bridge	SLI bridge

Socket 1366 Feature table

	Foxconn Renaissance	GIGABYTE GA-EX58-Extreme	GIGABYTE GA-EX58-UD3R	GIGABYTE GA-EX58-UD4P	MSI X58 Pro-E	MSI X58M
Price	\$318	\$449	\$275	\$330	\$339	\$254
Supplier	Foxconn	GIGABYTE	GIGABYTE	GIGABYTE	MSI	MSI
Manufacturer	www.foxconn.com	www.giga-byte.com.au	www.giga-byte.com.au	www.giga-byte.com.au	www.msicomputer.com.au	www.msicomputer.com.au
Chipset						
Chipset	Intel X58	Intel X58	Intel X58	Intel X58	Intel X58	Intel X58
RAID	Intel ICH10R, JMicron JM363	Intel ICH10R, JMicron JM322	Intel ICH10R, Gigabyte SATA2	Intel ICH10R, Gigabyte SATA2	Intel ICH10R, JMicron JM363	Intel ICH10R, JMicron JM363
Audio	Harp soundcard	Realtek ALC889A	Realtek ALC888	Realtek ALC889A	Realtek ALC889	Realtek ALC889
Ports						
PCI	1	2	2	2	2	1
PCI-E graphics	Four 16x, One 1x	Three 16x, One 4x, One 1x	Two 16x, One 4x, Two 1x	Three 16x, One 4x, One 1x	Three 16x, Two 1x	Two 16x, One 4x
DIMM	6 x DDR3	6 x DDR3	4 x DDR3	6 x DDR3	6 x DDR3	6 x DDR3
SATA II / eSATA	6 (RAID capable) / 2 (RAID capable)	10 (RAID capable) / 0	8 (RAID capable) / 0	8 (RAID capable) / 0	7 (6 x RAID capable) / 1	7 (6 x RAID capable) / 1
Audio	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, coaxial and optical S/PDIF out	4 x surround audio out, optical S/PDIF out	4 x surround audio out
Cooling						
Northbridge	Heatsink and heatpipe	Heatsink, heatpipe and optional waterblock	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink
Southbridge	Heatsink	Heatsink and heatpipe	Heatsink	Heatsink and heatpipe	Heatsink	Heatsink
VRMs	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	Heatsink and heatpipe	N
Fan headers	4	6	6	6	4	4
Bundled extras						
Cables	EIDE, 2 x S-ATA				EIDE, 4 x S-ATA	EIDE, 4 x S-ATA
Miscellaneous	N				CrossFire bridge	CrossFire bridge

Foxconn Flaming Blade

Flames may burn unwary users.

Street Price \$250

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 2x PCIe x16; 1x PCIe x4; 1x PCIe x1; 2x PCI; 1x EIDE; 1xFDD; 6x SATA

The first thing we noticed about the Flaming Blade is that it only has two 16x PCIe slots. However they both provide a full 16 lanes, and support CrossFire and SLI. A heatpipe stretches all the way across the PCB, linking the chipset, VRMs and Southbridge.

The lack of a third 16x PCIe graphics slots makes room for two PCI slots, a 4x PCIe slot and a 1x PCIe slot. There are only three DIMM slots though, which are placed so close to the CPU socket (in theory to increase signal transmission speeds) that we had to mount the fan on our heatsink on the wrong side of it else it fouled the first DIMM slot.

The Flaming Blade didn't perform particularly well, with its overall Media Benchmarks score of 1,499 firmly in the lower half of results. Clearly the blade had its flame extinguished at this point and was hacking and slashing without much of a fire show.

Overclocking the Flamingblade was a

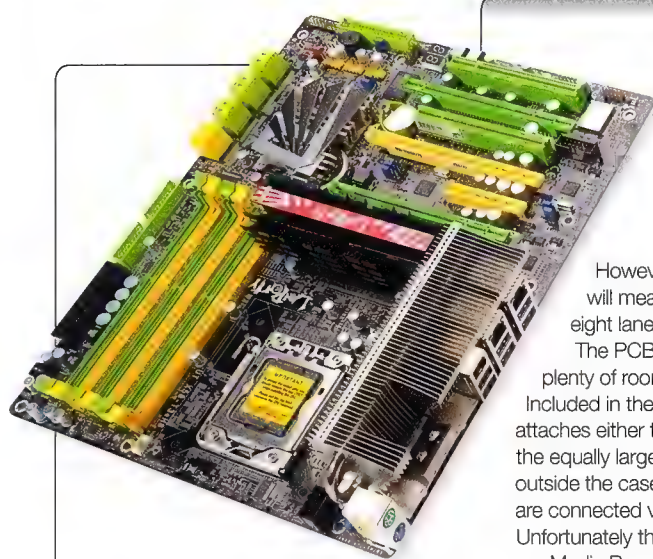
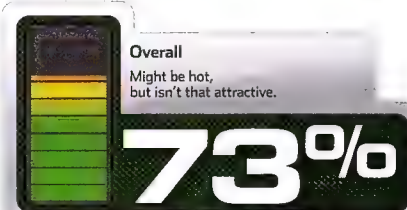
pleasant experience.

It recovered well from overzealous tweaking, although several voltage options lack absolute value readings.

There are plenty of options to keep even experienced overclockers happy though. We managed to increase the QPI to 195MHz, so with a CPU multiplier of 20x, our CPU was running at 3.9GHz. This required a vCore of 1.478V, CPU VTT of +200mV, a PLL of 1.8V, IOH of 1.35V and ICH of 1.54V. This saw the overall score in the Media Benchmarks rise to 2,095. Crysis saw the best improvement though, with the minimum frame rate hitting a highly flammable 35fps, the joint highest on test next to the Asus Rampage II Gene. By increasing the PLL to 1.88V and the IOH to 1.38V we managed to get the QPI up to



205MHz with a reduced CPU multiplier – a good, but not a record breaking, overclock. 



Motherboards from DFI's Lanparty series traditionally have BIOSes with an outrageous amount of settings. The Lanparty UT X58-T3eH8 certainly has quite a few features, including eight RAID-capable SATA ports, dual Gigabit Ethernet, a dozen USB 2 ports and two FireWire ports.

Of the three PCIe graphics slots, the bottom slot only provides eight lanes while the top and middle slots offer full 16 lanes.

However, installing three graphics cards will mean the middle slot also drops to eight lanes.

The PCB is exceptionally well laid out with plenty of room between all the components. Included in the box is a large heatsink that attaches either to the chipset heatsink or to the equally large VRM heatsink and so rests outside the case. All of the substantial heatsinks are connected via one continuous heatpipe. Unfortunately the DFI returned poor scores in our Media Benchmarks with an overall score of 1,424. Only the Foxconn Renaissance was slower.

The BIOS proved to be incredibly complicated and not particularly user-friendly. When we overclocked it too far the BIOS didn't autorecover either, requiring the PSU to be switched off and several sticks of RAM to be removed before it would POST again. Eventually we settled on a QPI of 195MHz, which required a vCore of 1.45V. This made the CPU run at

DFI Lanparty UT X58-T3eH8

Uber cooling, but it's slow and a very fussy overclocker

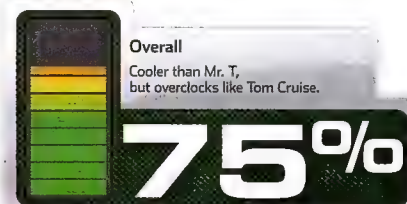
Street Price \$440

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 3x PCIe x16; 1x PCIe x4; 2x PCI; 1x EIDE; 1xFDD; 8x SATA

3.9GHz, boosting the Media Benchmarks score to a disappointing 1,978.

The DFI redeemed itself somewhat, managing a maximum stable QPI of 210MHz. This required the CPU multiplier to be dropped to 12x, the RAM reduced to its minimum divider and also needed the CPU VTT raising to 1.35V and the CPU PLL to 1.95V.

The DFI is the third most expensive LGA1366 motherboard on test. You'd expect a lot for \$440 but the DFI doesn't quite deliver despite having great cooling and a BIOS that is positively oozing with options. 



Foxconn Renaissance

Not quite enough to kick-start the revolution.

Street Price \$318

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 4x PCIe x16; 1x PCIe x1; 1x PCI; 1x EIDE; 1x FDD; 6x SATA

Despite being called Renaissance, there isn't anything new or innovative about this Foxconn motherboard. That said it does have four 16x PCIe slots, more than you'll find on most Core i7 motherboards.

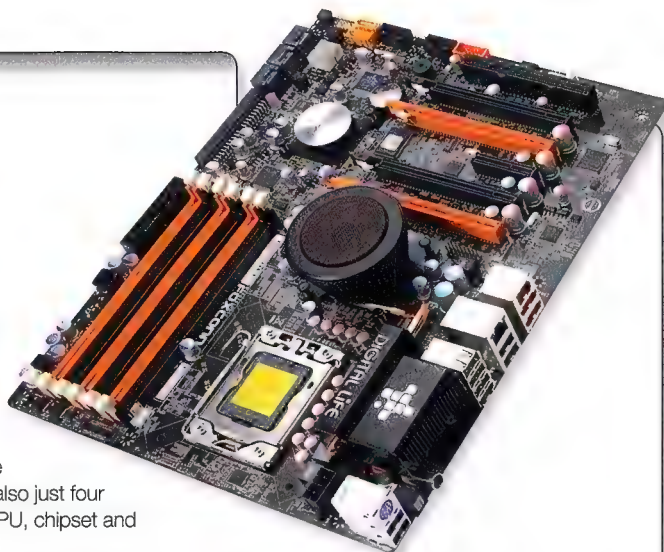
It also has a total of eight RAID-capable SATA ports and twelve USB ports with eight available on the I/O panel. Despite having three more DIMM slots than the Flaming Blade, the Renaissance has more space around the CPU socket for a large HSF. Layout on the whole is good and our only real niggle is the fact the Southbridge isn't linked to the heatpipe system that cools the chipset and VRMs. Instead it has its own fairly small heatsink.

At stock speeds the Renaissance put in a poor performance with an overall score of 1,403 - the lowest of all the LGA1366 motherboards. Its minimum frame rate of 31fps in Crysis was also behind the rest of the pack.

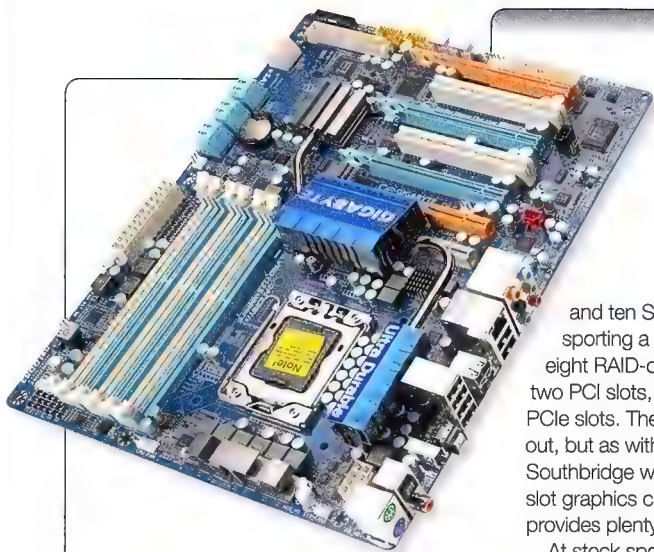
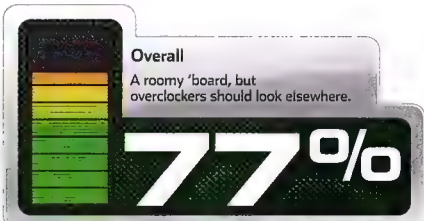
The BIOS was relatively easy to get to grips with, although you have to adjust some settings in increments rather than entering the absolute value you want. There're also just four voltage options - RAM, CPU, chipset and CPU VTT.

After a significant amount of tweaking and some hefty voltage increases we managed to overclock our Core i7-920 to 3.8GHz with a QPI of 190MHz using a vCore of 1.472V, a chipset voltage of 1.37V and a 200mV increase to the CPU VTT. This saw a significant leap in the Renaissance's performance with the overall score increasing to 2,003. Crysis saw a small improvement, with the minimum frame rate edging up to 33fps from 31fps.

Once we lowered the CPU multiplier to 12x we were able to push the QPI up to 210MHz - a



very good result. No matter how much further we pushed the voltages, the QPI refused to go any higher. (E)



GIGABYTE GA-EX58-UD4P

Room for three graphics cards from GIGABYTE.

Street Price \$330

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 3x PCIe x16; 1x PCIe x4; 1x PCIe x1; 2x PCI; 1x EIDE; 1x FDD; 8x SATA

The GIGABYTE GA-EX58-UD4P sits in between the GA-EX58 Extreme and EX58-UD3R in both features and price.

It has six DIMM slots and three 16x PCIe slots - the top and middle slots providing 16 lanes, while the lower slot is fixed at eight lanes. As with the Extreme, the middle slot will drop to eight lanes if you install three graphics cards.

The UD4P lacks the dual Gigabit Ethernet

and ten SATA ports of the Extreme, instead sporting a single Gigabit Ethernet port and eight RAID-capable SATA ports along with two PCI slots, one 4x PCIe slot and two 1x PCIe slots. The PCB is on the whole well laid out, but as with the UD3R, water-cooling the Southbridge will be impossible if you have a dual-slot graphics card. The BIOS is easy to use and provides plenty of options to tweak.

At stock speeds the UD4P recorded a respectable overall score of 1,510 in our Media Benchmarks. It managed a minimum frame rate of 32fps in Crysis, again, solid but not spectacular. We got the QPI to 195MHz resulting in a clock speed of 3.9GHz by raising the vCore to 1.45V. Other voltage tweaks proved fruitless in our quest for a higher overclock. This was also the same frequency achieved by the much cheaper UD3R, so we can't help feeling the UD4P doesn't offer a whole lot more for your money.

This idea was confirmed when we dropped the CPU multiplier in order to find out the maximum stable QPI of the UD4P. We could only push it to 205MHz, and again it didn't matter if we overvolted the board. In contrast the cheaper UD3R managed to run Prime95 stably at 210MHz, while the similarly priced Asus P6T Deluxe V2 managed 215MHz.

The EX58-UD4P is a good motherboard, but unless you're planning on using three graphics cards, the UD3R is much better value. (E)



MSI X58M

A cheap little mATX mobo.

Street Price \$254

Specifications Socket LGA1366; Intel X58 chipset; mATX form factor; 2x PCIe x16; 1x PCIe x4; 1x PCI; 1x EIDE; 1xFDD; 7x SATA

Micro-ATX motherboards are usually slow and terrible overclockers and have a significantly reduced feature set.

The MSI X58M goes a long way to buck this trend with two 16x PCIe slots, six DIMM slots and six RAID-capable SATA ports. The PCB layout is good, but there's no heatpipe cooling system - the chipset and Southbridge are cooled by heatsinks while the VRMs are left to the mercy of the elements. The BIOS is easy to navigate but you can't type in absolute values, you have to make changes in increments.

Despite its small size and lack of VRM cooling the X58M was able to max out our test CPU and overclock it to 4GHz with a QPI of 200MHz. What's more, this only required an increase in the vCore to 1.472V. However despite plenty more options available in the BIOS, no amount of tweaking made the board stable above this QPI. Even so, this

is a fantastic result for an LGA1366 motherboard that costs less than \$300.

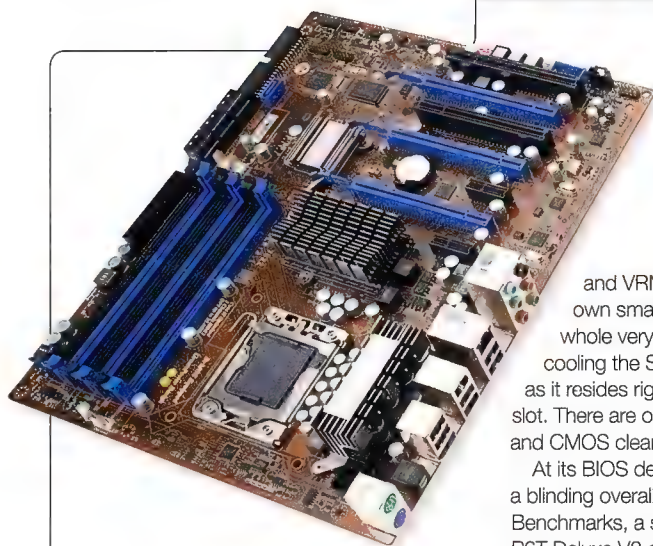
Unsurprisingly this overclock produced a sizable performance increase, with the overall Media Benchmark score rising to 2,147 - fifth overall out of all the LGA1366 motherboards. Crysis only saw an improvement of 1fps to its minimum frame rate though.

With the CPU multiplier dropped to its minimum value the MSI X58M managed a maximum QPI of 210MHz, an impressive achievement given that only seven LGA1366 motherboards managed a QPI higher than 205MHz. Only the Asus P6T Deluxe V2 managed a higher QPI, stretching to 215MHz.

Like the other micro-ATX LGA1366 motherboard, the Asus Rampage II Gene the MSI X58M sets a new standard for micro-



ATX motherboards, being both fast and overclockable. Given its very low price for an LGA1366 motherboard, it's definitely worth a look.



MSI X58 Pro-E

A solid effort but the Asus P6T SE is much cheaper

Street Price \$339

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 3x PCIe x16; 2x PCIe x1; 2x PCI; 1x EIDE; 1xFDD; 7x SATA

and VRMs. The Southbridge has its own smaller heatsink. The PCB is on the whole very well laid out, although water-cooling the Southbridge would be difficult as it resides right next to the primary 16x PCIe slot. There are onboard buttons for power, reset and CMOS clear.

At its BIOS defaults the X58 Pro-E turned in a blinding overall score of 1,530 in our Media Benchmarks, a score only the Asus P6T SE and P6T Deluxe V2 could top. It also performed well in Crysis, recording a minimum frame rate of 32fps.

With the vCore boosted to 1.48V we managed to increase the QPI to 195MHz, resulting in a CPU clock speed of 3.9GHz. Unfortunately, the X58 Pro-E consistently returned poor multitasking scores in the Media Benchmarks when overclocked and the best overall score it managed was 2,038. Crysis saw no improvement from the overclock.

The BIOS isn't the easiest to use as some of the voltage options lack final values, so it's hard to judge what they should set to. In the end we managed to get the QPI up to 200MHz, but only by dropping the CPU multiplier to 12x and lowering the RAM speed.

The X58 Pro-E is a solid motherboard that overclocks relatively well. It's slightly better specified than the X58M, but it has stiff competition in the form of the cheaper Asus P6T SE.



The X58 Pro-E has three 16x PCIe slots compared with the X58M's two, plus two PCI slots and two 1x PCIe slots. Otherwise the boards have a very similar specification, with a single Gigabit Ethernet port, up to 12 USB ports and six RAID-capable SATA ports.

The X58 Pro-E has better cooling than its micro-ATX brother though, with a heatpipe system linking the heatsinks on the chipset

ASUS P6T SE

A cheap little mATX mobo.

Street Price \$297

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 3x PCIe x16; 1x PCIe x1; 2x PCI; 1x EIDE; 1x FDD; 6x SATA

We're sure we're not alone in waiting for more affordable Core i7 motherboards to arrive and at last they finally have started to appear. The P6T SE is a cut down version of the highly successful P6T Deluxe V2; the P6T Deluxe was the first LGA1366 mobo we gave a hot award to (www.atomicmpc.com.au/?130920). So how good is it considering it retails over \$140 less?

Despite having three 16x PCIe slots, the P6T SE only supports CrossFire and not SLI. In addition, although the first two 16x slots provide 16 lanes the third slot only provides eight lanes. The P6T SE sports two PCI slots and a 1x PCIe, has six RAID-capable SATA ports and a single Gigabit Ethernet port. The heatpipe system only extends from the VRMs to the chipset - the Southbridge has its own heatsink.

At stock speeds the P6T SE returned an overall Media Benchmark score of 1,539

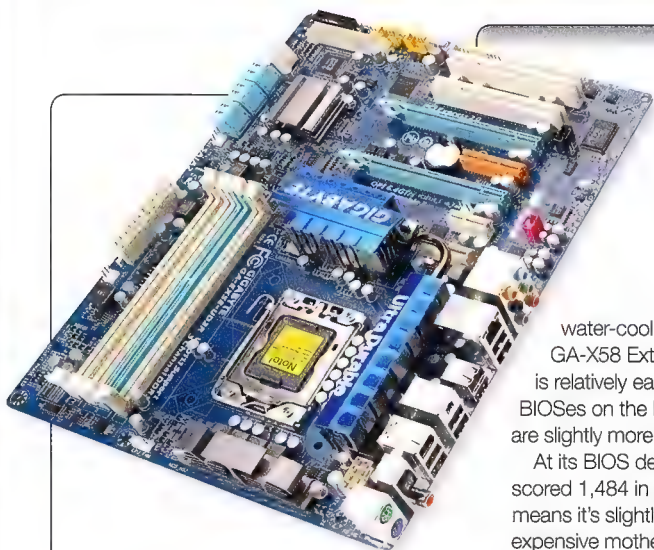
which eclipsed every other motherboard except for the more expensive P6T Deluxe V2. Its minimum frame rate in Crysis was also impressive at 33fps.

The BIOS was slick and easy to use, although extreme overclockers will have to adjust some jumpers on the board itself in order to access those crazy voltages. For example, the vCore is limited to 1.7V, but shorting a specific jumper will allow you to zap the CPU with a toasty 2.1V. We needed to increase the vCore to 1.45V and the ICH to 1.4V to be able to reach a QPI of 200MHz, which overclocked our test CPU to 4GHz. This overclock made the Media Benchmarks score rise to a respectable 2,126. Despite tweaking various other voltages we couldn't push the QPI any higher than 200MHz.

Apart from not supporting SLI, there are few



drawbacks to the P6T SE. A 4GHz overclock and sub-\$300 price tag mean it's definitely worth considering.



GIGABYTE GA-EX58-UD3R

GIGABYTE's budget offering ain't a bad choice.

Street Price \$275

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 2x PCIe x16; 1x PCIe x4; 2x PCIe 1x; 2x PCI; 1x EIDE; 1x FDD; 8x SATA

water-cool. The BIOS is very similar to the GA-X58 Extreme and GA-X58-UD4P and is relatively easy to navigate, although the BIOSes on the LGA1366 Asus motherboards are slightly more user-friendly.

At its BIOS defaults the GA-EX58-UD3R scored 1,484 in our Media Benchmarks. This means it's slightly faster than many more expensive motherboards such as the Foxconn Flamingblade and MSI Eclipse Plus. It performed respectably in Crysis with a minimum frame rate of 32fps.

Using a 20x CPU multiplier we pushed the QPI to 195MHz which overclocked our test CPU to 3.9GHz. This overclock was very easy to stabilise, only requiring the vCore to be raised to 1.45V. This resulted in a very respectable overall score of 2,064 in our Media Benchmarks and a 2fps increase in the minimum frame rate in Crysis - a few fps ahead of the majority of its competitors.

The GIGABYTE GA-EX58-UD3R is not packed to the gills like some LGA1366 motherboards, but it still has two CrossFire/SLI-compatible 16x PCIe slots and a single Gigabit Ethernet port. It also has a 4x PCIe slot, two 1x PCIe slots, four DIMM slots, eight RAID-capable SATA ports and 8-channel audio.

The only issue we had with the PCB is that a dual-slot graphics card will obscure the Southbridge, making it impossible to

After lowering the CPU multiplier to 12x and also reducing the speed of the memory, we were able to push the QPI all the way to 210MHz which is a stunning result given the GA-EX58-UD3R's low price. In fact, only the Asus P6T Deluxe V2 would overclock further, while both the GA-X58 Extreme and GA-X58-UD4P were slower still.

If you want the performance of a Core i7 CPU but only have a scant moth-infested \$275 for a motherboard then the GA-EX58-UD3R is well worth considering.



GIGABYTE GA-EX58 Extreme

Integrated chipset water-cooling, not a great overclocker.

Street Price \$449

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 3x PCIe x16; 1x PCIe x4; 1x PCIe 1x; 2x PCI; 1x EIDE; 1x FDD; 10x SATA

The GIGABYTE GA-EX58 Extreme has an impressive feature set with a massive ten RAID-capable SATA ports, six DIMM slots, dual gigabit LAN and an optional waterblock on the chipset with 3/8in watercooling barbs.

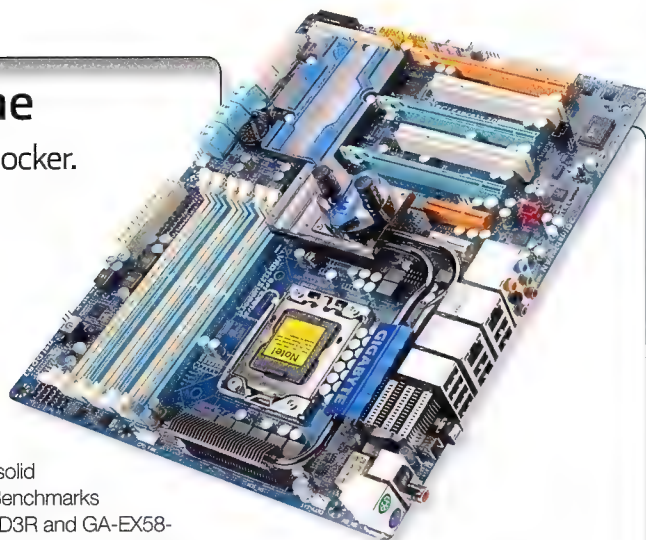
This waterblock is linked to the heatpipe system that also cools the VRMs and Southbridge, so could potentially save you money on separate waterblocks for these components. If you don't want to water-cool the GA-EX58 Extreme you can fit an additional heatsink onto the chipset to improve its cooling.

The PCB is very well laid out indeed, with no obstructed fan headers or power connectors and plenty of room for large CPU coolers. The BIOS is easy to get along with, although it's not laid out quite as efficiently as it could be. Of the three 16x PCIe slots, the upper most two provide 16 lanes while the bottom has eight lanes. With three graphics

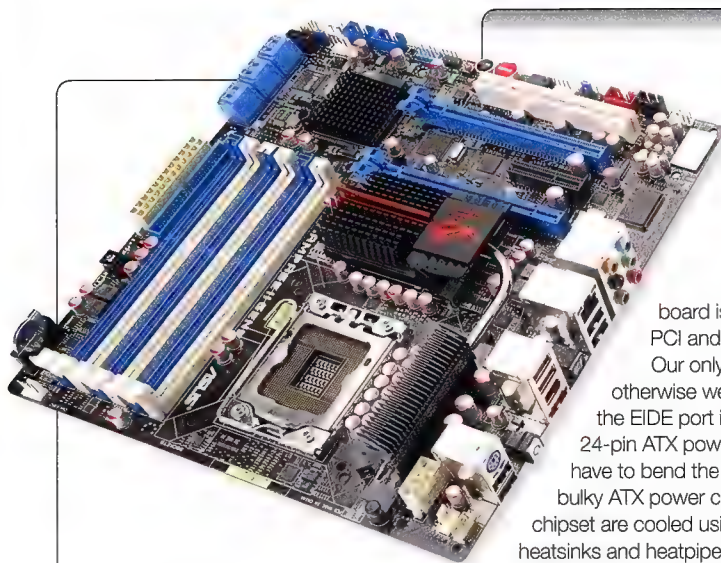
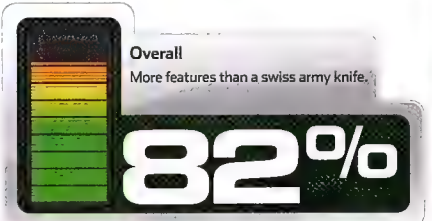
cards installed, the middle slot will also drop to eight lanes, but this shouldn't impact on performance.

At stock speeds the GA-EX58 Extreme managed a solid 1,521 overall in our Media Benchmarks - faster than the GA-EX58-UD3R and GA-EX58-UD4R. It also returned a solid but unremarkable result in Crysis with a minimum frame rate of 31fps. Overclocking the GA-EX58 Extreme proved to be slightly disappointing as we were only able to overclock our test CPU to 3.9GHz with a QPI of 195MHz. However this only needed a vcore increase of 1.45V and no other voltage increases. It recovered from overzealous tweaking well too.

Once overclocked the overall Media Benchmark score increased to 2,096 and the minimum frame rate in Crysis saw a 2fps increase to 33fps. We were unable to increase



the QPI any further despite reducing the CPU multiplier and RAM speed and tweaking various voltages in the BIOS.



The Rampage II Gene isn't the only Core i7 micro-ATX motherboard out there, but this model has more advanced features. For example it supports both LGA775 and LGA1366 CPU coolers and it also sports Asus' SupremeFX sound card with an optical S/PDIF output. Despite its compact dimensions there are six DIMM slots, six RAID-capable SATA ports and two CrossFire/SLI-compatible 16x PCIe slots. The rest of the

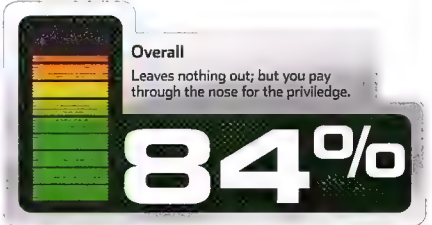
board is occupied by a single PCI and 4x PCIe slot.

Our only quail with the otherwise well laid out PCB is that the EIDE port is the wrong side of the 24-pin ATX power socket, meaning you'll have to bend the EIDE cable round the bulky ATX power cable. The VRMs and chipset are cooled using a combination of heatsinks and heatpipes, while the Southbridge has its own heatsink.

Out of the box the Rampage II Gene proved to be very quick, with an overall score of 1,524 in our Media Benchmarks. The BIOS provides many options to tweak and is easy to use. After some experimentation we managed to max out our Core i7-920 to 4GHz by raising the QPI to 200MHz. This only required increasing the vCore to 1.475V. At this frequency the overall score in our Media Benchmarks rose to a dizzy 2,159. We managed to push the QPI to

210MHz without having to tweak any other voltages, but could not go any higher, even with lots of extra voltage.

We're massively impressed with the minuscule Rampage II Gene - it sets a new standard for micro-ATX motherboards. Unless you really feel the need to fully populate your motherboard with expansion cards it's well worth considering. The only downside to picking this one is the giant price; almost twice as expensive as the cheapest mobo in this roundup.



RAZER

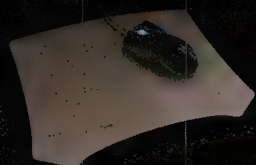
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ASUS P6T Deluxe V2

Sitting at the tippy-top of the X58 mountain.

Street Price \$437

Specifications Socket LGA1366; Intel X58 chipset; ATX form factor; 3x PCIe x16; 1x PCIe x4; 2x PCI; 1x EIDE; 1x FDD; 6x SATA



The original P6T Deluxe nabbed a Hot Award as the first Core i7 mobo we'd looked at thanks to its abundance of features and great overclockability. The P6T Deluxe V2 is ASUS' refresh of the P6T Deluxe, although the differences are very slightly indeed.

The only change we could see between the P6T Deluxe and the P6T Deluxe V2 is the omission of a SAS controller and associated SAS ports on the V2. As a result the V2 only sports six RAID-capable SATA ports.

Both models have three 16x PCIe slots, supporting up to 3-way SLI and CrossFire. With two graphics cards fitted, the first two slots provide the full 16 lanes each and the third slot eight lanes. With three graphics cards installed, both the second and third slots drop to eight lanes each. In addition there are two PCI slots and a single 4x PCI-E slot. Both banks of VRMs, the chipset and Southbridge are cooled by a large heatsink and linked together by a heatpipe that snakes across the PCB.

Combined with onboard power and reset switches, dual Gigabit Ethernet ports and a maximum of 14 USB 2 ports, the P6T Deluxe V2 stacks up pretty well.

The ASUS BIOS is a dream to use and is infinitely more user friendly than DFI's awful BIOS. Like the P6T SE, you can adjust the voltage of almost every component/bus in the BIOS, but can set them higher still by adjusting several jumpers on the PCB – a sensible idea as the settings available via these jumpers are enough to fry your PC if it isn't adequately cooled. Unless you're benchmarking with DICE or liquid nitrogen, we'd suggest leaving these jumpers well alone.

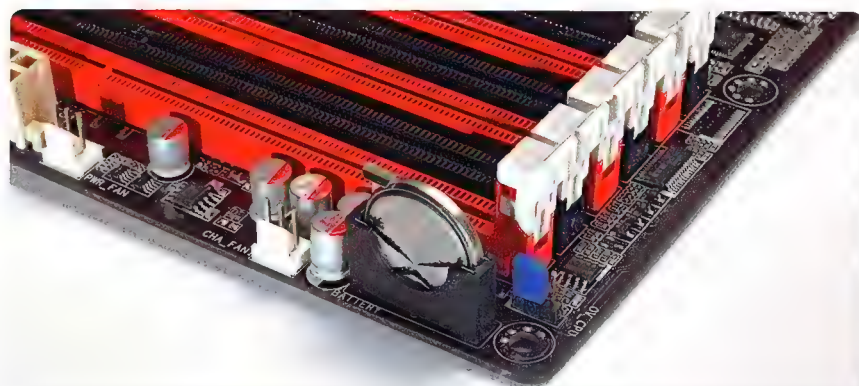
At stock speeds the P6T Deluxe V2 recorded a very high score of 1,537 in our Media Benchmarks. It managed a smooth minimum frame rate of 32fps in Crysis, although both the P6T SE and Rampage II Gene managed 33fps. We set to work in the BIOS and managed to raise the QPI to 200MHz resulting in a CPU frequency of 4GHz. This required a vCore of 1.475V, but no other voltage increases were needed meaning that even big overclocks are relatively easy to achieve.

This overclock saw awesome increases in the P6T Deluxe V2's performance, with the overall Media Benchmarks score increasing to 2,170. Crysis failed to see any improvement though, and the minimum frame rate remained at 32fps. We headed to the BIOS again to see what we could push the QPI to if we removed any bottleneck provided by our RAM or CPU.

When we reduced the CPU multiplier to 12x, lowered the RAM speed and applied a CPU PLL of 1.9V, a QPI/DRAM core of 1.3V and an IOH voltage of 1.4V, we were able to reach a massive 215MHz QPI – the highest of all the motherboards.

Both full-size ATX motherboards were able to unlock an additional CPU multiplier in our Core i7-920 (upping it from 20x to 21x), which boosted the clock speed slightly when overclocking. However due to the extra power draw caused by this cheeky overclock, the CPU kept throttling when running Prime95. However as the CPU did not throttle back when running our Media Benchmarks and Crysis it's possible you may be able to reach the limit of the QPI of your system.

Although the P6T Deluxe V2 is the best LGA1366 motherboard on the market, it doesn't offer a compelling upgrade for existing P6T Deluxe owners. For those who simply want the best combination of performance, features and overclocking the P6T Deluxe V2 is unbeatable.



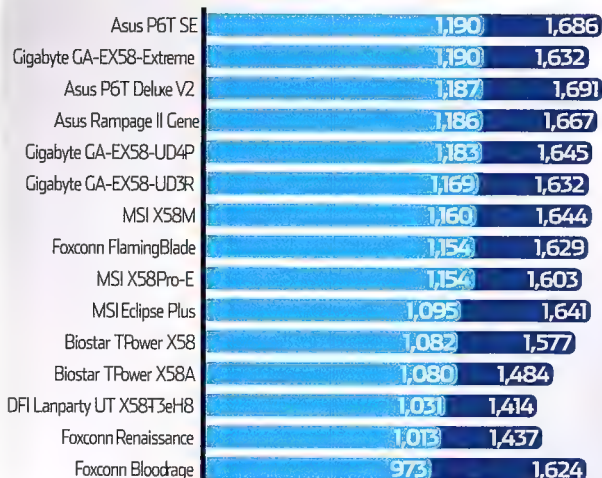
These jumpers unlock additional overvolting options in the BIOS.



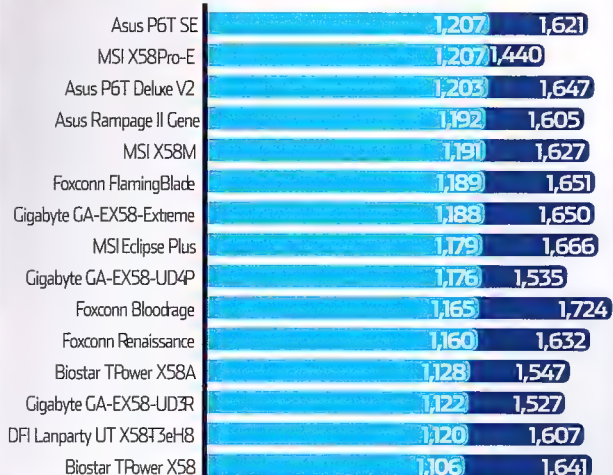
Standard

Overclocked

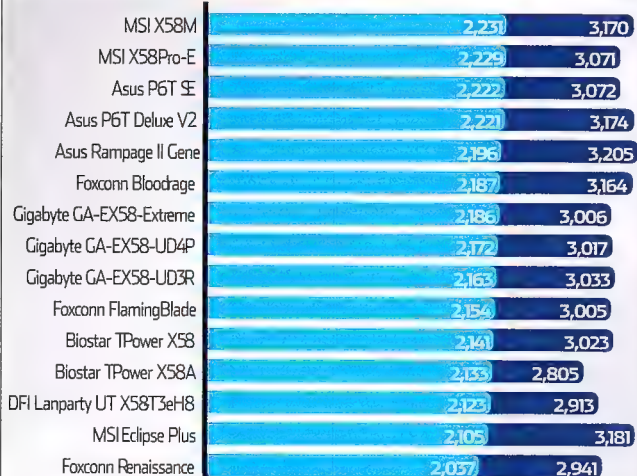
GIMP Image editing



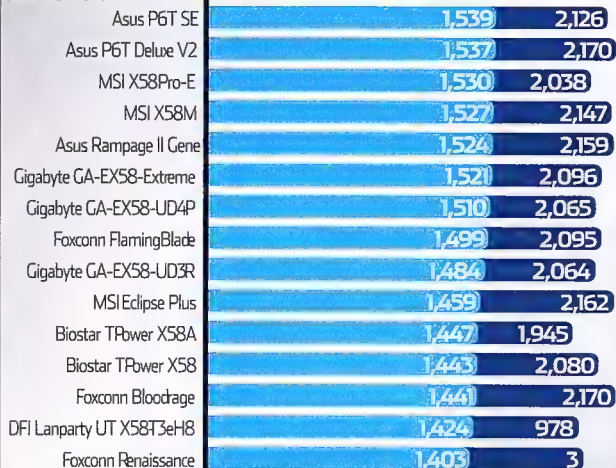
Multitasking



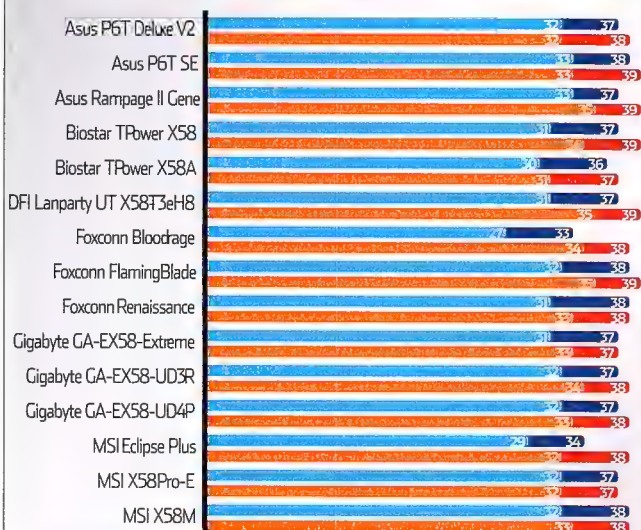
Handbrake H.264 video encoding



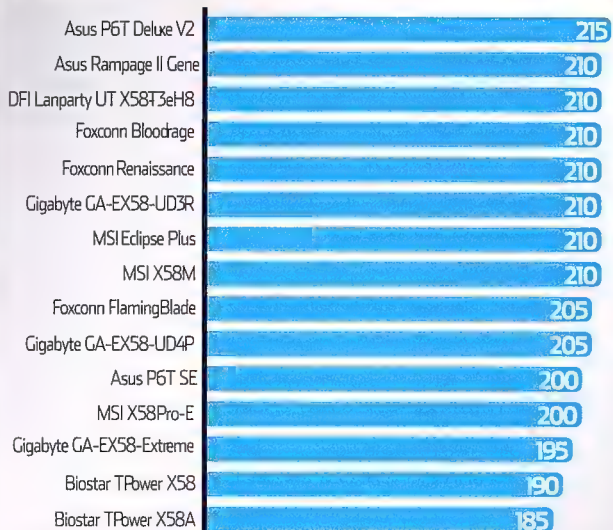
Overall



Crysis 1680x1050 2x AA "high"



Maximum stable QPI



Min Avg O/C min O/C avg

Megahertz



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COMES GREAT
ANNIHILATION

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JOHNATHAN "FATAL1TY" WENDEL



The OCZ Fatal1ty Champion series offers gamers stable and efficient power for their mainstream or high-end rigs. These high-performance power supplies were co-developed by Johnathan "Fatal1ty" Wendel, 12-time World champion, to meet the specific needs of fellow gamers and provide incredible performance to power the latest graphics and hard drives. OCZ is dedicated to delivering premium power solutions, and the Fatal1ty series options are the first step to creating an exceptional system for the unique power and cabling requirements of today's gamer.

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How hot is too hot?

Daniel Rutter gets hot under his drives.

You won't be able to keep your fingers in 50°C water for much more than a second without being scalded. Water above about 88°C will scald you instantly. But it's possible for a PC with lousy ventilation to get so hot that the outside of the case is too hot to touch, and still work!

For a while.

The general scientific rule that heat makes reactions go faster applies to many components in PCs, but you generally don't want reactions to happen in your computer components. You want all of the elements to remain compounded with all of the other elements in their original configuration, and you want all of the metal bits to stay the same shape.

Heat works against this; sweating plasticiser

A better solution is to focus cooling on the areas that really need it.

The CPU and graphics card are the obvious candidates, but stock coolers for those components are pretty good these days, and there are umpteen upgrade options. Even motherboard core-logic chips usually have a hefty stock cooler these days, sometimes adorned with questionably-effective heat-pipes leading to a remote radiator.

What you won't find, though, are many ways to improve your hard-drive cooling.

There are two reasons for this.

One: Hard drives don't actually make a lot of heat. 3.5in hard drives generally only consume single-digit watts of power, so that's all the heat they can emit.

of the six slots (...with a couple more drives in 5.25in bays, naturally), but that still gave me some piping-hot HDs.

So I removed the side of the case, and hung a fan off one end of the drive cage, blowing across the gaps between the drives. Down between the drives, the casings still make it to 18 or so degrees above ambient, but they're a long way from 'too hot to touch'. And, for more than two years, they've been the least troublesome hard drives I've ever had.

A half-naked computer is not, of course, a very elegant way to keep drives cool.

So when you buy or build your next PC, make sure everything gets some air flow, not just the CPU and cards. 

Dan Rutter is like a breath of fresh air.

dan@atomicmpc.com.au

... PC enthusiasts often have computers that sound as if NASA's got a transonic aerodynamic test rig hiding in there somewhere.

out of wire insulation, increasing the resistance of all sorts of components (which begets a little more heat), and encouraging metal atoms to 'electromigrate' down the minuscule conductive traces in chips. Electromigration in ICs is actually measured by artificially heating the chip, so that the atoms will get blown down the wire fast enough for lifespan numbers to be calculated in a reasonable amount of time.

If you're a (relatively) normal person with a (relatively) normal air-cooled PC, it's generally a good idea to keep its components as close to the ambient air temperature as possible. This is especially the case if you want to run your CPU and/or graphics card faster than stock; which is why PC enthusiasts often have computers that sound as if NASA's got a transonic aerodynamic test rig hiding in there somewhere.

Two: Hard-drive cooling is difficult to do if it isn't incorporated into the case design. 3.5in drive mounts in PC cases are usually a cheek-by-jowl block, with no room to install fans or heat-sinks. When there are only one or two drives you can usually install them with empty bays on either side, but users like us tend to fill more and more bays as time goes by.

You can mount a 3.5in drive in a 5.25in bay by using cheap extender rails or a fancier adapter, but if you want the more straightforward option of fans blowing into the 3.5-inch bays, or sucking out of them, or both, then you're going to have to get a case with mounts for such fans, or rig some gimcrack arrangement of your own.

The PC I'm typing this on has one of those cheek-by-jowl drive bays; I've only filled four



KITLOG

Everyone dreams of having the ultra-uber powered warrior capable of crushing mere mortals underneath its feet, but most civilians out there don't have those capabilities - and this is where the *Soldier* comes into play. Check out the individual pieces in the mag Issues, or type the ID into your favourite browser (eg www.atomicmpc.com.au/?136681). While he might not have the latest in high-tech gear, the Soldier can get things done and keep his cool on the online battlefield.

Wargear

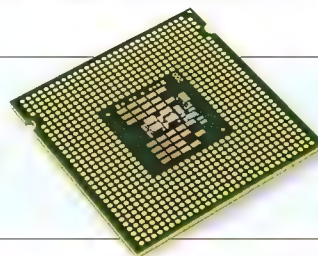
Every Soldier needs a weapon, and the 4770 has the best tactical advantage on the field. With a memory capacity of 512MB GDDR3 rounds, the RV740 core fires pixels at a sufficient rate. Perhaps not the most powerful; but it is reliable.



The *Commando* is in a class of her own; supplied with only the most powerful experimental weaponry and trained from birth to be a coolly calculating killing machine. She's compatible with almost everything under the sun, slicing through benchmarks with surgical precision and leaving all others behind in the dust. Always in control of the situation thanks to the best gaming gear from the RnD labs, her top-notch audio systems relay every heartbeat of her targets. If you need the best, the *Commando* will not dissappoint.

THE SOLDIER

CPU



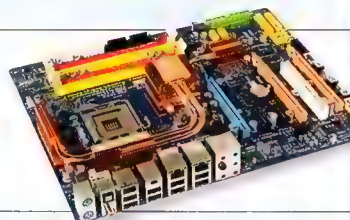
Intel Core 2 Quad Q8400
PRICE \$240

Intel's budget chip can rocket over 4GHz on air!
Issue 103, Page 36

MOTHERBOARD

GIGABYTE EP45-UD3P
PRICE \$200

The most solid P45 mobo we've tested, cheap too.
Ref ID: 136681



MEMORY



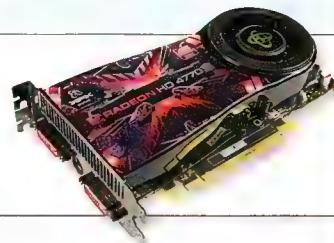
Patriot PC2-8500 C5
PRICE \$109

Fast, tweakable and not too expensive.
Ref ID: 92524

VIDEOCARD

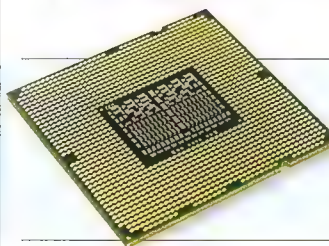
XFX 4770
PRICE \$175

Cheap doesn't mean slow; can play most games well.
Ref ID: 151293



THE COMMANDO

CPU



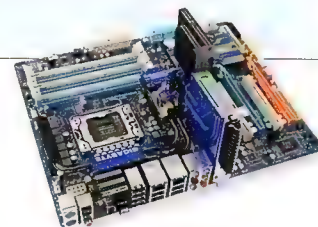
Intel Core i7 975
PRICE \$1570

Fastest chip you can buy. Period!
Issue 102 - Page 36

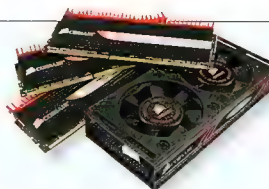
MOTHERBOARD

GIGABYTE EX58-EXTREME
PRICE \$440

Dripping with features, awesome performance and nice OCer.
Ref ID: 135617



MEMORY



Corsair Dominator TR3X6G1866C7GTF
PRICE \$388

Plenty of memory, blisteringly fast and darn sexy.
Ref ID: 149838

VIDEOCARD

XFX GTX295
PRICE \$729

Fastest high-end card yet, grab two for even more speed!
Issue 104, Page 36





Aywun A1V8

PRICE \$52

Performs well, incredible value, bloody awesome.
Issue 103, Page 47

CASE



Cooler Master CM690

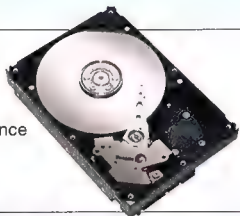
PRICE \$120

A spacious case with nice cooling, and quite stylish too.
Ref ID: 101716

640GB HDD

PRICE \$90

Best price/storage/performance choice out there.



KEYBOARD

Razer Arctosa

PRICE \$58

A cool-looking keyboard that'll serve you very well.
Ref ID: 149483



AOC 2216Vw

PRICE \$225

Great 22in widescreen for all your gaming needs.
Ref ID: 122168

MOUSE



Verbatim Rapier VI

PRICE \$65

Great gaming performance and nifty features.
Issue 96, Page 43

Plantronics Gamecom 777

PRICE \$94

Solid set of cans with great audio.
Issue 101, Page 41



Onboard Realtek ALC889A

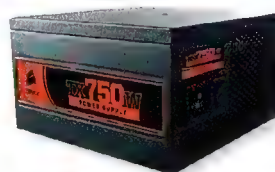
A decent chip that does the job.

POWER SUPPLY

Corsair TX-750

PRICE \$199

Quiet performance, great noise and plenty of cables.
Ref ID: 107260



SUBTOTAL: \$8047



Thermalright Ultra 120 eXtreme 1366 RT

PRICE \$99

Best air cooling for Core i7, quiet and reliable.
Ref ID: 84583

CASE



Coolermaster ATCS 840

PRICE \$370

Heaps of fans, plenty of space, and dripping with quality.
Ref ID: 132479

Patriot Torqx 128GB SSD

PRICE \$620

Lightning-fast speed for your OS; chuck a HDD in for storage.
Issue 103, Page 45

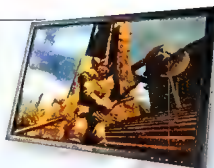


KEYBOARD

Microsoft Sidewinder X6

PRICE \$80

Backlit, sturdy, magnetic numpad & macro keys; what's not to like?
Ref ID: 129535



Dell 2408WFP

PRICE \$989

A huge 24in LCD screen for your prettiest pixels.
Issue 103, Page 57

MOUSE



Microsoft Sidewinder X8 Wireless

PRICE \$105

Cable-less, comfortable, lag-free and fraggable!
Ref ID: 148422

Logitech Z-5500D

PRICE \$450

Earth-shakingly good.
Issue 48, Page 56



Auzentech X-Fi Prelude

PRICE \$279

Best soundcard ever!
Ref ID: 112419

POWER SUPPLY

Corsair HX-1000

PRICE \$355

Will power everything and the kitchen sink – quietly.
Ref ID: 132918



Always on the move, never stopping for long, the *Ranger* is a highly mobile specialist unit. Designed for quick insertion behind enemy lines, his lightweight outfit manages to pack a surprisingly powerful punch, and his intelligence is well above the average recruit. He's got a handle on the situation at all times, drifting in to secure victory before returning to base, ready to do it all over again. If you need mobility, speed and performance, the *Ranger* has got you covered.

Wargear

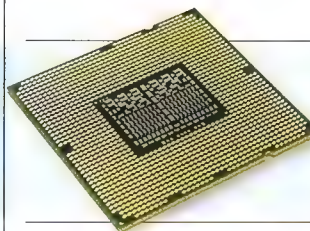
When you're dropped into enemy territory the last thing you need is an audio SNAFU; so grab a set of these heavy-duty cans for great audio performance at a low cost. Sound sounds better through these, and the included boom mic just keeps on transmitting.



Keeping communication lines open at all times is the *Uplink's* role, as she quietly serves up essential mission data from high-density storage discs. Interfacing with a hybrid input device, she packs plenty of storage in with equally zippy computing hardware. You'd hardly notice she was in the room, but without her expert organisational skills you'd be lost in a sea of information. If you've got a need for quiet, interruption-free multimedia viewing, the *Uplink* specialist is the only choice.

THE RANGER

CPU



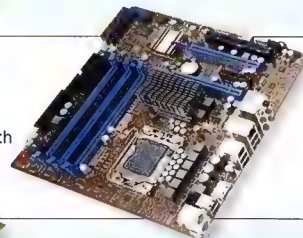
Intel Core i7 920
PRICE \$400

Intel's budget chip can rocket over 4GHz on air!
Issue 103, Page 36

MOTHERBOARD

MSI X58M
PRICE \$260

Teensy X58 mobo with heaps of value.
Issue 104, Page 58



MEMORY



G.Skill PC3-12800 C8 π Series
PRICE \$165

Six gigabytes of fast memory.
Issue 102, Page 45

VIDEO CARD

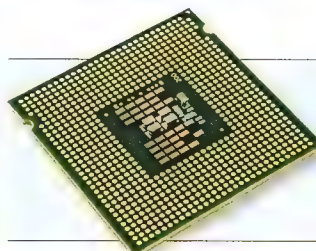
ATI 4870
PRICE \$200

Sturdy performance, but temptingly low price.
Issue 92, Page 36



THE UPLINK

CPU



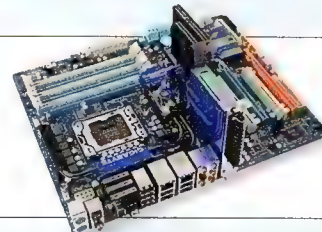
Intel Core 2 Quad Q8400
PRICE \$240

Quadcore to chew through video encoding.
Issue 103, Page 36

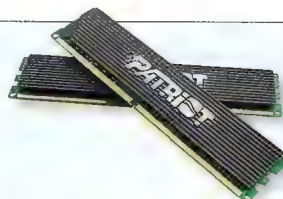
MOTHERBOARD

GIGABYTE EP45-UD3P
PRICE \$200

The most solid P45 mobo we've tested; cheap too.
Ref ID: 135617



MEMORY



Patriot PC2-8500 C5
PRICE \$108

Fast, tweakable and not too expensive.
Ref ID: 92524

VIDEO CARD

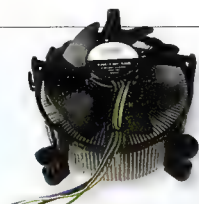
Zotac 9400GT Zone
PRICE \$95

Silent as the grave, and HD playback is perfect.
Ref ID: 137603



SUBTOTAL: \$1977

COOLER



Intel Stock Cooler

PRICE FREE

Does the job, fits under PSU well.

CASE



Silverstone SG04

PRICE \$195

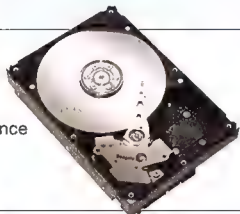
Small case with handle; add two 120mm fans for awesome cooling.
Ref ID: 148266

SYSTEM DRIVE

640GB HDD

PRICE \$90

Best price/storage/performance choice out there.



KEYBOARD

Razer Arctosa

PRICE \$58

A cool-looking keyboard that'll serve you very well.
Ref ID: 149483



DISPLAY



AOC 2216Vw

PRICE \$225

Great 22in widescreen for all your gaming needs.
Ref ID: 122168

MOUSE



Verbatim Rapier VI

PRICE \$65

Great gaming performance and nifty features.
Issue 96, Page 43

AUDIO

Plantronics Gamecom 777

PRICE \$94

Solid set of cans with great audio.
Issue 101, Page 41



Onboard Realtek ALC889A

A decent chip that does the job.

POWER SUPPLY

GIGABYTE ODING T 850

PRICE \$225

Beefy, quiet and modular.
Ref ID: 132943



SUBTOTAL: \$2309

COOLER



Aywun ATV8

PRICE \$52

Performs well, incredible value, bloody awesome.
Issue 103, Page 47

CASE



Antec Sonata Elite

PRICE \$150

Quiet and vibration dampened, subtle and avoids attention.
Issue 100, Page 46

SYSTEM DRIVE

Seagate Barracuda 1.5T

PRICE \$179

Fast, voluminous storage for all your pr0n, videos and music.
Ref ID: 141622



KEYBOARD

Logitech diNovo Edge

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Wireless board with a trackpad for mousing.



OPTICAL



LG GGC-H20L

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Blu-ray and HDDVD playback - best of both worlds

FAN



Scythe Gentle Typhoon

PRICE \$27

Quiet fan moves lots of air; lower RPMs are quieter.
Ref ID: 150102

AUDIO

Razer Mako 2.1 Speakers

PRICE \$469

Stylish tub-thumpers.
Ref ID: 126695



ASUS Xonar HDAV 1.3

PRICE \$279

Nice sound, expansion good.
Ref ID: 135112



POWER SUPPLY

Corsair TX-750

PRICE \$199

Quiet performance, great noise and plenty of cables.
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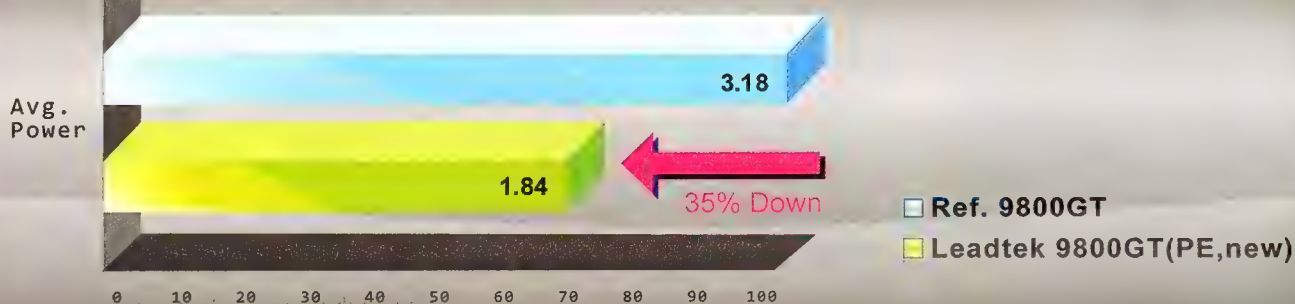
512MB GDDR3 Version

35%

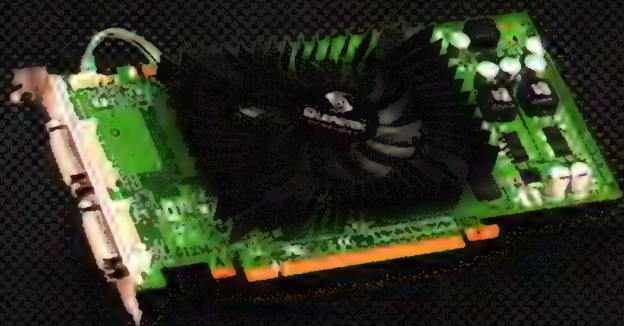
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Power Consumption

Avg.(Watt.)

Leadtek 9800GT(PE,new)

63.31

Ref. 9800GT

96.94



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LEADTEK

TUTORIAL

HANDS-ON TUTORIALS FOR THE TECHNICALLY MINDED

This month we get down to video cards basics, and teach you everything you need to know about probably the most important part of a gamer's rig.

Our complete Buyers' Guide walks you through how these cards work, what the jargon means, and what to look for in a new purchase. We even take the latest releases through a brand-neutral test to find the best performance-to-price solution. It's a great refresher for old-timers,

and essential for newcomers to the realm of performance computing.

After that, we're joined by Chris Taylor as he walks uni students through the pitfalls and requirements of a good study regime.

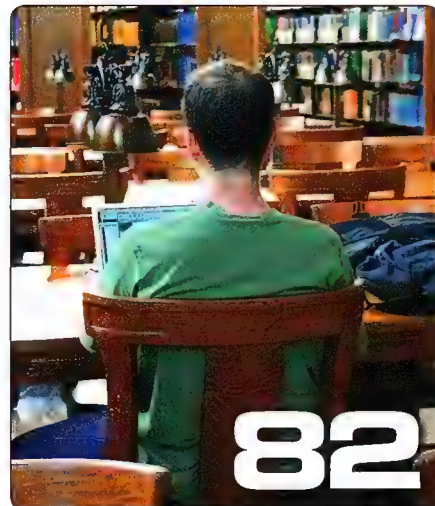
Finally, our resident Geek gets her angry on, as EA shows off just how little it gets girl-gamers. And there's t-shirts, too. Zara's nothing if not complex.

Enjoy and learn!

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Everything you ever needed to know about graphics cards.	
Atomic.edu: Studying Skills	82
Essential advice on how to stick to good habits and cope with the demands of university.	
Geec Chic	85
EA, sexism and cool t-shirts.	



82



To celebrate the release of Season 4 of the stunning sci-fi epic **Battlestar Galactica** on Blu-ray, we've got five copies of the season to give away. Want to see a lot of toasters fracked? Then you know where to go!

www.atomicmpc.com.au/competitions

Ultimate guide to graphics cards



Choosing a graphics card is a tough decision for any gamer or enthusiast, so we've compiled this guide to everything you need to know about this important component. If you're in the market for a new graphics card, we'll show you how to work out which is the best one for you and your PC.

Everyone knows you need a powerful graphics card if you want to play the latest games, but just what goes on under the hood of a graphics card and how do you go about choosing the right card for you?

In this ultimate guide, the CPC team presents a multi-stage guide to everything you need to know about the graphics card. We start by ex-

plaining at a process level what a graphics card actually does and then go onto to deciphering some of the most commonly used terms and acronyms in a comprehensive technical dictionary.

We then tackle one of the most crucial decisions when upgrading a PC – what graphics card(s) to buy. To answer this question we've benchmarked a variety of cards at several differ-

ent resolutions with two different CPUs so you can see which combination of hardware provides the best performance at a given price point.

Finally, as even the most powerful and expensive, graphics cards struggle to play all games smoothly at high resolutions, the last section of this feature explores how to overclock your graphics card in order to boost its performance.

What graphics card should I buy?

In all fields of expertise there's theory, and there's practice. Sometimes, the difference is slight (say, philosophy), and sometimes the difference is visceral, as with, say, bull-fighting, bungee-jumping and boxing. Deciding which graphics card to buy can often feel like the latter – you read up on the technology, scour the reviews and yet all too often the huge number of cards on sale seem to actively work against your ability to make a decision you feel confident with. In this section of the feature we're going to show you how to make the best decision, and to prove it can be done, we're going to analyse one of the toughest sections of the graphics market: the \$300 to \$600 zone. Brutal price drops and fierce competition make it a place many fear to tread, but we'll show you exactly how to get what you want.

Know your PC

The first step is to survey your own PC. If you want to buy a new graphics card for gaming, then your only real option is a PCI Express card (PCIe). Nvidia appears to have almost totally given up on the older AGP standard, and while ATI has made a not-completely-terrible AGP GPU in the shape of the Radeon HD 3850, it retails for a high price (\$200) in relation to the performance it offers. If you still have an AGP motherboard, you'll be better off in the long run replacing it with one that supports PCIe. Graphics cards are power-hungry, too, so you need to know what your PC's PSU is like. You'll need one that not only delivers enough total wattage

for the system, but also has a strong 12v rail, as this is where the graphics card draws all its power from. In addition, graphics cards, particularly high-end models, often need specific types of power plugs, usually a combination of one or two 6- and/or 8-pin PCIe connectors. You can buy converters that turn Molex plugs into PCIe power connectors, but this increases the cost and complexity of your PC's wiring.

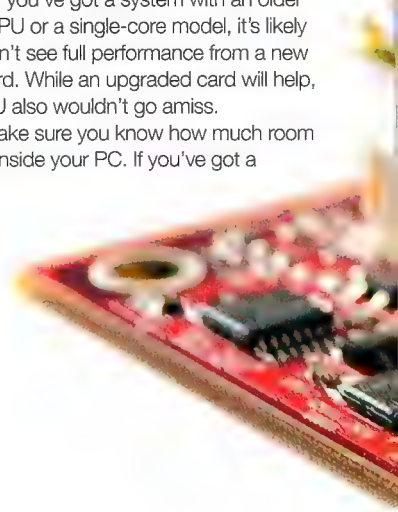
If you want to use your existing PSU, it's not that easy to find out if it will be able to cope with a new graphics card: in part this is because not all PSUs of the same wattage are equal, and it's also because both Nvidia and ATI are very poor at revealing the power requirements of their graphics cards. Also, your system's power requirements will be impacted by the CPU and motherboard you use, the number of hard disks you use, and whether your CPU is overclocked – as heavy overclocking can almost double the power draw of your processor.

Outer Vision Extreme's PSU calculator (www.extreme.outervision.com/psucalculatorlite.jsp) can come in handy to give you a rough idea of what PSU you'll need. The minimum PSU we recommend is a 550w model and this should be fine for a PC with a stock-clocked or slightly overclocked dual- or quad-core CPU, with a single graphics card and hard disk.

Once you've considered your motherboard and the PSU, the next item to look at is your CPU. A graphics card is fed with data by other components inside the PC, and if these

components can't keep up, then performance of the graphics card will be compromised and you won't see its full potential. Of all the other components in the PC, it's the CPU that has the biggest impact upon the graphics card. In the second half of this section we've tested how various graphics cards perform with different CPUs, so you can see the variation. How much CPU performance a game needs varies from title to title, but if you've got a system with an older dual-core CPU or a single-core model, it's likely that you won't see full performance from a new graphics card. While an upgraded card will help, a faster CPU also wouldn't go amiss.

Finally, make sure you know how much room is available inside your PC. If you've got a



small PC or Shuttle case, you may not be able to fit in a dual-slot graphics card, or you may need to shuffle around PCI add-in cards. Also, bear in mind that high-end graphics cards are typically around 9.5 to 10.5in long.

Choosing a new card: First steps

When it comes to choosing a graphics card, it's important to know the distinction between a GPU and a graphics card. A graphics card is an add-in board for your PC, featuring a GPU, an amount of memory for the GPU, plus power circuitry to keep them fuelled, cooling apparatus to stop them melting, and output ports to feed video to a variety of display types (see over the page for a more detailed explanation of the components).

The GPU (Graphics Processing Unit) is by far the most important component on the card, and the most critical piece of kit in your PC when it comes to making games look good and play smoothly. Two companies design GPUs – ATI (now wholly owned by AMD) and Nvidia. They then produce their GPUs in Taiwan-

ese factories, and sell them to board partners (companies such as EVGA, XFX and Asus), who make the graphics cards you buy in the shops.

When deciding on a graphics card to buy, it's the GPU you ought to focus on, then the amount of memory, and finally considerations such as the cooler and ports. Finding the GPU the card is based on will also help when looking for reviews – there are thousands and thousands of different graphics cards, so not all get tested and reviewed, but every major GPU of the past five years has been covered in the pages of Atomic.

Win the name game

ATI GPUs always have 'Radeon' in the title and Nvidia's always have 'GeForce.' After this, there's a lot of numbers and letters. The first thing to bear in mind is that bigger is not always better, and newer is not always newer – a GeForce GTS

250 is virtually identical to a GeForce 9800 GTX+, for instance.

ATI and Nvidia both produce a range of GPUs, separated into series, which can then be roughly split into top-of-the-range, high-end, mid-range and budget GPUs. Take the Radeon HD 4890: the '4' tells us it's in the 4000-series, at the time of writing, ATI's newest design. The 870 puts it at the top-end of the scale – it's above the 4850, and well above the 4600 and budget 4500.

Sometimes you'll see letters suffixed after the number, for example the Radeon HD 4870 X2. In this case, the X2 denotes it's a card with two GPUs on it – and consequently very high-end. Currently, Nvidia is more keen on suffixes than ATI, and it does make it more difficult to tell what's going on and what card is faster than another.



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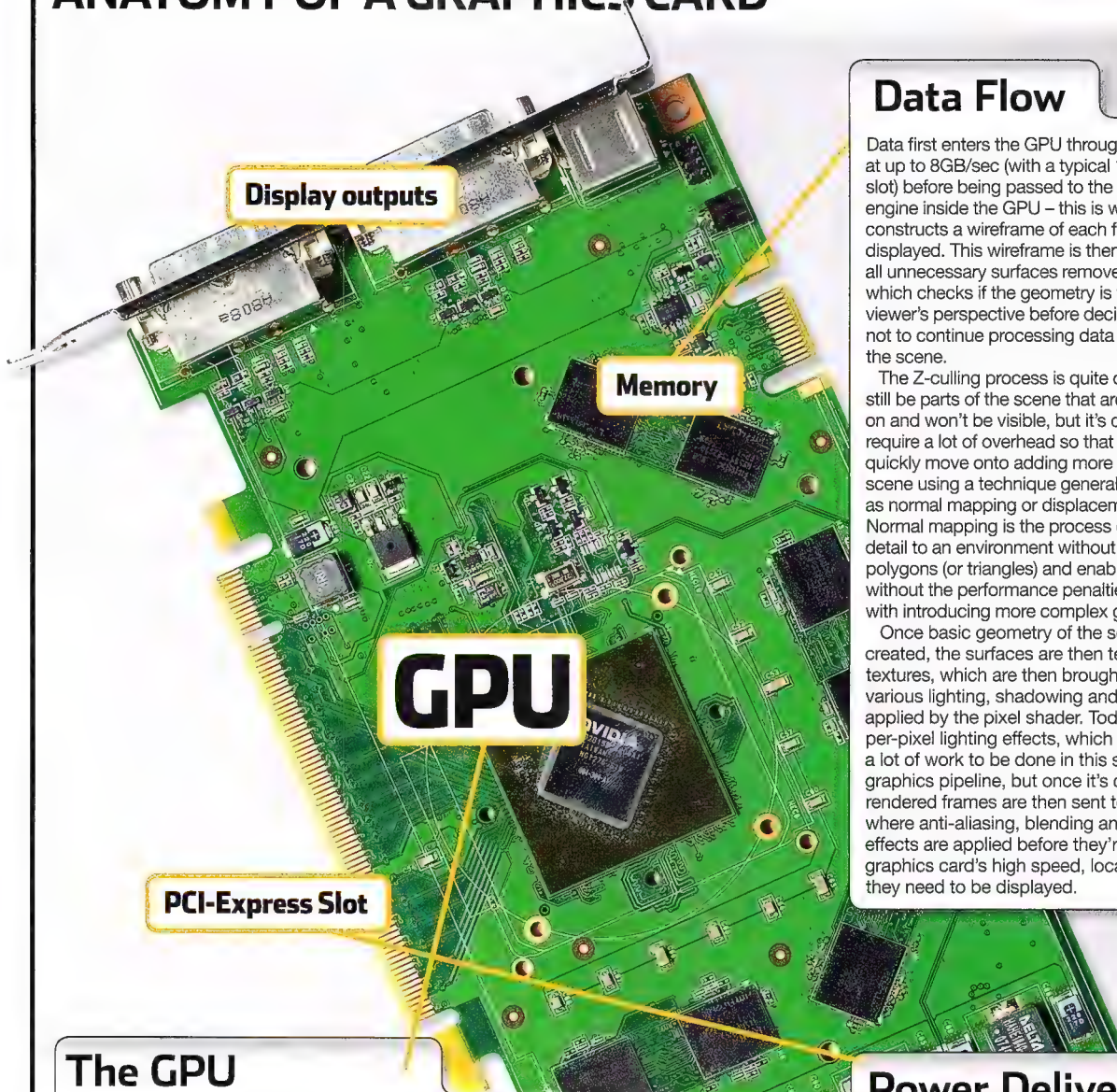
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ANATOMY OF A GRAPHICS CARD



Data Flow

Data first enters the GPU through the PCI-E bus at up to 8GB/sec (with a typical 16x PCI-E 2.0 slot) before being passed to the triangle setup engine inside the GPU – this is where the GPU constructs a wireframe of each frame being displayed. This wireframe is then optimised with all unnecessary surfaces removed via a Z-cull, which checks if the geometry is visible from the viewer's perspective before deciding whether or not to continue processing data for that part of the scene.

The Z-culling process is quite coarse, so there'll still be parts of the scene that are being worked on and won't be visible, but it's designed to not require a lot of overhead so that the GPU can quickly move onto adding more detail into the scene using a technique generally referred to as normal mapping or displacement mapping. Normal mapping is the process of adding more detail to an environment without creating more polygons (or triangles) and enables higher fidelity without the performance penalties associated with introducing more complex geometry.

Once basic geometry of the scene has been created, the surfaces are then textured with flat textures, which are then brought to life with the various lighting, shadowing and particle effects applied by the pixel shader. Today's games use per-pixel lighting effects, which means there's a lot of work to be done in this stage of the graphics pipeline, but once it's complete, the rendered frames are then sent to the ROPs, where anti-aliasing, blending and other final effects are applied before they're sent to the graphics card's high speed, local memory until they need to be displayed.

The GPU

The GPU is the brain of the graphics card and is a massively parallel processor. It's made up of tens of small processing or 'shader' units that are optimised for graphics workloads, but which have become increasingly flexible over the past few years. It controls the flow of data from the application (i.e. the game) to your PC's display, as instructions are sent from the game to the CPU, and then onto the GPU for processing. Once the GPU has finished creating the pixels, they're pushed out onto your PC's display.

When used in its traditional graphics mode, the shader units inside the GPU are responsible for applying special effects to the pixels on your screen, which include lighting, shadowing, smoke and particle effects. More recently, the GPU has also been used to ac-

celerate the physics effects that are now being introduced into many game engines.

Plus, there's an increasing focus on the GPU's general-purpose capabilities as well – the GPU can be used to offload other, parallel workloads that aren't traditional 3D tasks. Windows 7 will have native support for GPU acceleration in many general-purpose, but highly parallel computing tasks. Windows Media Center in Windows 7 will feature support for high-definition video decoding for the first time. This is a task that requires massive amounts of data to be processed in real time in order to render a video at a smooth frame rate and many CPUs aren't up to this task – especially with higher quality videos with bit-rates of up to 40Mbps.

Power Delivery

A good power circuit is essential to ensure the card runs efficiently and effectively. The circuit has to be robust enough to handle the power requirements of the GPU when it's placed under heavy loads, but it also needs to be able to deliver decent power efficiency when the GPU is idling or under light workloads.

For this reason, even mid-range graphics cards use multi-phase power circuits for the GPU and memory, so that each part of the card can run in its most efficient state at all times. Moreover, many of today's mid-range graphics cards, such as the GeForce 9600 GT pictured here, require additional power from one or more supplementary PCI-E power connectors.

The PCI-E specification allows an add-in card to draw up to 150W of power through a 16x PCI-E 2.0 slot and all current graphics cards support this specification. However, ATI and Nvidia graphics cards still only draw 75W through it in order to retain backwards compatibility with first generation PCI-E motherboards.

THE GRAPHICS CARD DICTIONARY

Graphics cards and GPUs share nearly as many acronyms as a meeting of the heads of NATO – so here's a handy guide to the most commonly used terms.

AA (Anti-aliasing) – a post-processing technique that smoothes the edges of jagged diagonal lines. Anti-aliasing works by examining the colour values of the pixels surrounding a line and then averaging those values to create a smoother, less jagged finish.

AF (Anisotropic filtering) – a post-processing technique that reduces the distortion of textures when viewed at oblique angles such as in the far distance.

AGP (Accelerated Graphics Port)

– the serial bus by which most graphics card made between 1997 and 2004 were connected to the motherboard. AGP slots were available in various speeds, but the standard has been superseded by the parallel PCI-E bus (q.v.) in recent years and is no longer supported by the vast majority of new motherboards and graphics cards.

CrossFire – The brand name for ATI's proprietary method of using two or more Radeon HD GPUs to render alternate frames of a game, thereby increasing the frame rate. CrossFire is widely supported by certain graphics cards and motherboards.

DisplayPort – A new type of 20-pin digital video connection, intended to replace DVI (q.v.). Since its introduction into the market last year some graphics cards and displays have supported DisplayPort, but the standard has yet to really gain traction.

D-SUB – The colloquial name for the 15-pin D-subminiature connector used by most monitors and graphics since 1987. As D-SUB carries analogue video it requires a RAMDAC (Random Access Memory Digital to Analogue Converter) on the graphics card to convert its output from digital to analogue before it can be transmitted through the D-SUB connector. Usually has a blue-coloured connector.

DVI – Digital Visual Interface; introduced in 1999 as the replacement for the analogue 15-pin D-DUB (q.v.) connector. It's a 29-pin digital connector that provides superior image quality to D-SUB, and usually has a white-coloured connector.

GPU – Graphics Processing Unit; this is the main chip on a graphics card. Most GPUs are designed by ATI, Nvidia or Intel and are designed to perform multiple comparatively simple calculations in parallel that determine the colour value of individual pixels. The awesome calculating power of the GPU can also

be used for other tasks (see GPGPU).

GPGPU – General Purpose Graphics Processing Unit; software that uses the calculating power of a GPU (q.v.) to run applications other than rendering games. Current examples include PhysX (q.v.) and Folding@home – a protein folding medical simulation.

FPS – Frames per second; a frame is a single full-resolution image on your screen. Animated sequences comprise multiple frames rendered and displayed one after another. For a sequence to appear smooth and seamless, rather than jerky, the number of frames rendered per second (also known as the frame rate) should be at least 25.

HDMI – High Definition Multimedia Interface; a 19-pin connector that can carry both video and audio data in a digital stream. HDMI was first introduced to the TV and home cinema market in 2003 but in recent years has started to appear on some graphics cards and PC monitors.

HSF – Heatsink fan; all semi-conductor chips produce waste heat that has to be dissipated to prevent overheating and electromigration, which can result in system instability. Heatsinks work by transferring this heat into a nest of metal fins which in turn are cooled by a fan blowing air over the fins. Most HSFs simply recirculate this hot air around the inside of your PC, but a few designs improve upon this by blowing the hot air out of the back of the case.

PCB – Printed Circuit Board; a multi-layered sandwich of plastic and copper sheets on which all the main chips and components of a graphics card (GPU, RAM etc) sit, linked together by copper traces. Most graphics card PCBs have eight to 12 layers.

PCI-E – Peripheral Component Interconnect Express; first introduced in 2004 as a replacement for AGP (q.v.) this bus is now used by the majority of graphics cards and other daughter cards to communicate with the motherboard. Unlike the earlier AGP and PCI buses, PCI-E is a serial bus, so each slot has a point to point connection with the core logic chipset on the motherboard. This means that each slot can be configured to run at a different performance level – determined by the number of PCI-E lanes there are between it and the core logic chipset. Early PCI-E 1.0 slots provided 250MB/sec bandwidth per lane, whereas the now more common PCI-E 2.0 standard provides 500MB/sec per lane. Most slots provide either one, four, eight or 16 lanes and are referred to as 4x PCI-E

slots, 8x PCI-E slots etc.

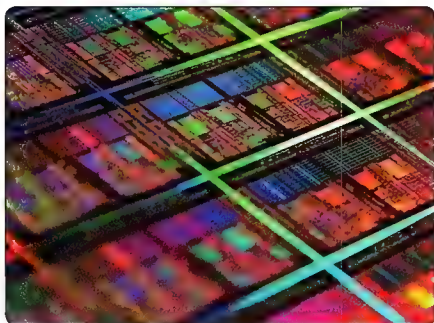
PhysX – A game physics calculation API originally developed by Ageia, which was bought by Nvidia in early 2008. The API runs on the now-discontinued PhysX processor and all Nvidia GeForce GPUs with a unified shader architecture (GeForce 8 and later). PhysX is supposed to help developers create more realistic physical effects in games, but has yet to have a significant impact on the market.

ROP – Render Output Unit/Raster Operations Pipeline; the final stage of the rendering process in the GPU before an image is output to the monitor. ROPs combine all the data from the calculations performed within the GPU core (q.v.) and local memory into a complete frame. Modern GPUs typically include between four and 32 ROPs.

Shader – A type of software instruction used by games to create images and effects. In DirectX 10, there are, broadly speaking, three types of shader instruction: vertex shaders, pixel shaders and geometry shaders. Vertex shaders compute geometry – i.e. the shape of 3D objects. Pixel shaders are used to determine the colour of individual pixels, and so can be used to create special effects such as shiny surfaces. The Geometry shader allows the graphics pipeline to create geometry quickly and easily, useful in situations where you need a lot of similar but not identical forms (e.g. grass, leaves or hair).

SLI – The brand name for Nvidia's proprietary method of rendering alternate frames on two or more GeForce GPUs, thereby increasing the frame rate. SLI is only supported by certain graphics cards and motherboards.

Stream processor – prior to the introduction of the stream processor in late-2006 by Nvidia in the GeForce 8800 GTX, GPUs had a mixture of pixel and vertex shaders. These were fixed function, so could only compute certain types of shader (q.v.) instruction. In contrast, a stream processor is a general purpose maths processor that in a GPU, can compute many different instructions in addition to pixel, vertex and geometry shader code. When arranged in parallel, stream processors are highly effective at performing the calculations required to render graphics. As stream processors are simply maths processors, they can also be used for many other types of task, known collectively as GPGPU (q.v.).



Shiny GPU cores in their native state. Sexy!

While the model name and number give some idea about how a GPU will perform, technical specifications are a better indication (although of course, actual benchmarks are even better). Both ATI and Nvidia's current GPUs use what's called a 'unified shader architecture,' so inside the GPU are a number of stream processors. Currently, ATI's designs feature many more stream processors than Nvidia's competing GeForce, but Nvidia's stream processors are designed differently, and can handle different types of calculations. For this reason, it's not generally useful to directly compare stream processors between Radeon and GeForce, but they are useful to allow you to compare between different GPUs in the Radeon range (and different GeForce).

Stream processors aren't the only spec you'll want to keep an eye on: also bear in mind how fast they run. Current ATI cards clock stream

having 1GB of memory. While it's rare for quantity of memory to make a substantial difference to performance (although it does happen, as in the case of the HD 4870), memory speed does make a difference. In particular, watch out for suspiciously cheap cards that on closer inspection use slower GDDR2 or GDDR3 memory.

Analysing performance

Now that you've looked at your PC, and are aware of how to determine what GPU a card features, and that GPU's key specifications, it's time to try to get an angle on its performance. Unless you've got ready access to a vast stockpile of graphics cards, the only way to find out about performance is to look at benchmarks. You'll come across two types of benchmarks when looking at reviews of graphics cards, which are usually referred to as 'synthetic' and 'real world.' Synthetic benchmarks are written from the ground-up to be benchmarks, and the most well-known are the 3DMark series. These do have their uses (they're usually free to download, require little time to set up and generate a single 'score'), but we prefer real-world benchmarks.

These are tests that utilise actual games that you can play. In some titles, it's possible to record a 'timedemo' – a series of actions and movements – which can be played back in the game engine and timed in order to generate scores, whereas in others, we simply play through a specific area of the game with a tightly defined set of actions and record the performance. To do this, we use an application called FRAPS (www.fraps.com) a

The Key Questions to answer

- Can my PC run this card?
- How does it perform in games I am interested in, and at settings relevant to me?
- What other cards are available for a similar price?
- How do the other cards perform in games and settings relevant to me?
- Does spending less result in significantly less performance?
- Does spending more result in significantly more performance, and does this performance result in the ability to play with better settings?

These pre-overclocked cards usually cost more than standard cards, although the premium you pay varies.

processors at the same speed as the rest of the GPU architecture, whereas with Nvidia's current designs the stream processors run much quicker than the rest of the GPU.

While ATI and Nvidia specify the speed at which the GPU should run, the board partners are then free to tinker with this, so many firms sell pre-overclocked cards, backed by guarantees. These pre-overclocked cards usually cost more than standard (also called 'reference') clocked cards, although the premium you pay varies. The degree to which these overlocks increase actual performance in games also varies, so you should investigate thoroughly before buying a pre-overclocked card.

There's one more specification to look at: memory. Both ATI and Nvidia will specify a standard amount of memory clocked at a certain speed, but board partners are free to tinker with this, too. Don't assume that a card with 1GB of memory is automatically any faster or better than one with 512MB. More memory comes in most useful when you're gaming at higher resolutions, so there's little point in a \$200 graphics card which will be used for gaming at 1280 x 1024

freely available utility that can accurately record the frame-rate of a DirectX or OpenGL game.

We include a variety of game benchmarks in our reviews and we try and strike a balance between keeping our selection up-to-date, and keeping it consistent so that you can compare graphics cards between issues. For each game used in this guide's benching, we've tested at three screen resolutions, and at each resolution we use different AA and AF settings, although in-game detail settings are always set to maximum.

To get best use out of the benchmark data, first focus on which games you're interested in, and then look at the settings that most closely mirror your own. If you don't have a 24in screen, and don't plan on getting one in the near future, how a card performs at 1,920 x 1,200 shouldn't be of paramount importance to you. As much as we write many positive things about powerful, high-end hardware, you may find that cheaper graphics cards perform perfectly well at settings relevant to you and as such, would be a better buy.

Now you've found the graphs most relevant to you, what should you be looking for? Our benchmarks graph scores in frames-per-second



Crysis is the pinnacle of PC graphics - but you'll need a powerful graphics card to play it smoothly.

(FPS): literally, how many frames (full screen images) the system is displaying every second. The PC needs to be able to display at least 25 frames every second in order to create a smooth sensation of motion. Scores higher than 25 are welcome, especially as the FPS will fluctuate in a game, depending on the level and your actions, but above a certain point, you won't be able to see the difference. A frame rate of 80fps will look identical to a frame rate of 70fps, for instance.

Frame rate isn't as simple as one number, though. We graph two values: the average frame rate over the duration of the benchmark, and the minimum, and it's the minimum we attach most importance to. Let's take an example: if a graphics card achieves a high average – say, in the 40 or 50fps range – but has a minimum of 10 or 15fps, you'll perceive the action as jerky. Every time the frame rate plummets, you'll feel the system stutter. For this reason, a card needs to be able to achieve a minimum frame rate of 25fps or better at a resolution to make the game feel consistently smooth.

Features and Extras

In addition to considering performance, you may also want to think about other features of the card, such as its cooler, and performance in GPGPU applications such as Folding@home. These considerations don't tend to be as complex as performance; if you care about Folding@home, get an Nvidia card, as they massively outperform ATI's Radeon.

In terms of noise, the amount produced by reference coolers varies dramatically – some are loud, such as the Radeon HD 4890, while others such as the GeForce GTX 260 (rev 2) are very quiet. Cards featuring quieter coolers aren't that difficult to find (such as Sapphire's Vapor-X models) and such well-behaved coolers will be flagged up in our reviews.

Money, money, money

Now that you're armed with the requisite knowl-

edge of how to interpret benchmark data, it's time to address the final consideration: money. Only you know how much you can really afford to spend on a new graphics card, but it's important to give it some consideration. You should also consider it with the rest of your PC. As we mentioned at the start of the article, performance in games is largely but not solely determined by the graphics card, and if you've got an old system, it may be in need of a new motherboard and CPU. Certain games respond particularly

... a card needs to be able to achieve a minimum frame rate of 25fps or better to make the game to feel consistently smooth.

well to better CPUs – Crysis loves the Core i7, while GTA IV is a fan of quad-core chips.

When you see the range of graphics cards available it's easy to say 'ah, well the next one up is only another \$100', and to repeat this process endlessly. 'Only' is a dangerous word and a method that puts it into perspective is to express the price differences between each card not in terms of dollars, but as a percentage – a Radeon HD 4870 X2 is 'only' \$100 or so more than a GeForce GTX 275, but that's a price difference of over 20 per cent.

Once you've set out the price differences between the cards in your budget, you need to work out which offers the best 'bang for buck' – that is, for every extra dollar you spend, how much extra performance do you actually get? The easiest way to do this is to concentrate on one set of benchmark results, and compare the figures of the cards within your price range, focussing on the minimum frame rates. This is relatively simplistic of course and will give a somewhat limited picture. For a more complete overview of performance, you should look at how the cards you're investigating perform in

a range of games. Below, we're going to do just that for a few of the main contenders in the highly contentious \$200 to \$600 price bracket.

Picking a graphics card: A case study

In this section we're going to move from theory to practice, by applying what we've learned to choose between five graphics cards that are available for between \$220 and \$600. \$200 or so is the ideal sum for getting a new graphics card with excellent performance, but price drops and competition mean that if you start with \$300, you rapidly hit a dilemma: there are great cards available for \$220, and there are great cards for \$500. If you go up to \$500, you're then also not that far off being able to afford the fastest graphics card currently available, the Radeon HD 4870 X2.

We decided to compare five graphics cards: the aforementioned Radeon HD 4870 X2 (around \$600), the extremely closely matched Radeon HD 4890 (around \$300), GeForce GTX 275 (around \$350) and at the lower end of the scale, the GeForce GTS 250 1GB (around \$220) and as an example of an older card with a lowered price, the Radeon HD 4870 512MB (around \$220).

First, we sorted the cards by price: the Radeon HD 4870 X2 is about 40 per cent more costly than the GTX 275 and 27 per cent more than the HD 4890, which in turn more than the GTS 250 and HD 4870. That's a significant difference between each tier, and it should be

easy to determine whether the extra price gets us performance.

To keep down the number of results to consider, we've used two games, at three test resolutions: Crysis, because it's incredibly demanding, and Race Driver: GRID, as it's a good example of a typical console port that, while looking good, doesn't need much from PC hardware. We're not recommending you do this when actually making your choices – we're simply doing this so that in this feature, you can see how the process works with only a few numbers, before starting a more complex consideration.

Solely in terms of minimum frame-rates, the HD 4870 X2 is clearly stronger than the other cards – it's the only card to hit 25fps in Crysis at 1,680 x 1,050, and is only 1fps off at 1,920 x 1,280. In comparison, the GTX 275 can almost keep pace at 1,680 x 1,050 (23fps) although it falls away at the higher resolution. In GRID, while the HD 4870 X2 blasts past the other cards, the differences won't matter as much – the game is playable on every card at the highest resolution we tested at.

We've got a nice neat number to express how much extra the HD 4870 X2 costs, so we

decided to try a quick 'bang-for-buck' calculation too. It's just to give ourselves a rough guideline, so it's not too precise, but sometimes one number is very helpful. We used Excel to add up all the minimum frame rates for each card from the six tests (two games, three resolutions each), and then divided by six to get an average. This is the number we compared, and interestingly, the HD 4870 X2 is 21% quicker than the GTX 275, even though it costs more than 40 per cent more.

With this in mind, we decided to take a closer look to see if it does justify the extra cost. If you're looking to game at 1,280 x 1,024, the answer is clearly 'no': at that resolution, the GTX 275 has all the performance you need. At 1,680 x 1,050, the answer is less clear-cut: the HD 4890 really suffers in Crysis, but this game does usually hand the advantage to the Nvidia, so you might want to put more stock in its GRID performance, where it's virtually identical to the GTX 275 (in fact, if you read a full review of these cards, you'll find that Crysis aside, the GTX 275 enjoys only a slender advantage over the HD 4890 in most games).

So at 1,680 x 1,050 we can pare our choice down to two graphics cards, the GTX 275 and the HD 4870 X2. The GTX 275's minimum is 2fps slower than the HD 4870 X2 – only eight per cent – but its minimum is 19 per cent slower. Both from abstract numbers, and from the fact it hits a 25fps minimum, the HD 4870 X2 is close to justifying its higher price at this resolution. What would probably swing it is how much Crysis matters to you, and how the GTX 275 performs in a wider range of games.

Finally, how do the cards compare at 1,920 x 1,200? Again, in GRID, both cards are comfortable, but it's clear the HD 4870 X2 is significantly more powerful – the fact that it averages over 100fps is a good indication that you can expect to see plenty of powerful results in other games, and a look at a full review with a full set of benchmarks will show that's the case. In Crysis too, the HD 4870 X2 puts clear distance between itself and the GTX 275, with an average that's 38 per

cent higher than the GTX 275. If you're playing at high resolutions then, even from this limited set of results, indications are that the HD 4870 X2 is, for the price, a bit of a bargain.

Upgrading with an older CPU

All of the tests above were performed in our standard graphics test rig, which uses an Intel Core i7 CPU. We use this very quick CPU as it prevents the processor from being a bottleneck and we can see the true performance of each graphics card. However, if you're using a low-end processor then your CPU could cause a bottleneck in the system and inhibit your new graphics card from fulfilling its potential.

To illustrate this point, we set up a rig based around an Intel Pentium E5200 processor and benchmarked it using the same graphics cards and in the same tests as with the Core i7 rig above. The E5200 is a dual-core CPU with a stock speed of 2.5GHz and can be bagged for as little \$90.

With an HD 4890 helping it churn out the visual splendour of Race Driver: GRID, the minimum frame rate hit 39fps at 1,920 x 1,200 with 4x AA. Even at 1,280 x 1,024 with 2x AA the game still ran with a minimum frame rate of 40fps. Normally, dropping the resolution and AA would see a significant increase in the minimum frame rate as the lower resolution and less anti aliasing means less work for the GPU – so clearly what we're seeing here is that the CPU is acting as a bottleneck in the PC, stopping the graphics card from fulfilling its potential. In the Core i7 machine, the same card had a minimum frame rate of 83fps in GRID at 1,920 x 1,200.

As the budget Pentium CPU struggles to keep up with the high-end graphics cards, the performance gap between the Radeon HD 4870 and the GeForce GTX 275 is significantly lower than when both are in a Core i7 system. Likewise, spending that extra 40-odd per cent per

SLI vs CROSSFIRE

To further complicate matters, not only do you need to figure out which card to buy, but both ATI and Nvidia market multi-graphics systems, CrossFire and SLI respectively. These enable you to buy more than one graphics card and run them simultaneously, provided you have a compatible motherboard and compatible cards. Theoretically, this results in better performance, but in all the testing we've done over the years at Atomic, we've never seen consistently good-enough returns in the vast majority of games to justify the cost. Unless you're specifying a top-of-the-range PC, you're almost always better off buying a pricier single graphics card than two cheaper cards. With a single card, there are fewer points of failure and you're less reliant on regular driver updates and games playing ball to get full performance.

cent on the Radeon HD 4870X2 would only net you an extra 1.7 per cent performance increase (using our one rough-and-ready one numeral metric of average minimum FPS).

In contrast, the Radeon HD 4890 is about 30 per cent more expensive than the GTX 250, yet delivers around 35 per cent performance gain on the Nvidia model, making it a worthwhile upgrade. This is a good example of the problems with matching super-end end graphics cards with low-end CPUs. Not only will you save money opting for a mid-range card, but the extra wedge you saved could go towards a CPU upgrade in the future. Your new CPU will both complement your new graphics card for better games performance in addition to helping your PC to run faster overall.

Spending the money on a very high-end graphics card might get your kudos, but you won't be seeing the full return on your cash. 

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Study Skills

Problems studying? Chris Taylor gives you a much needed push in the right direction.



The leap into university life can be very disorienting whether you're fresh out of school, transferring from TAFE or returning to study after a few years in the workplace. The university system requires motivation and resourcefulness. A university student is an independent learner. Even in your first year, you won't be spoon fed solutions to your problems. Studying is a skill. Good study involves more than simply showing up to classes, doing whatever tasks are assigned to you and occasionally perusing the assigned textbooks. If you want to succeed, if you want to truly get your money's worth – and let's face it, even with HECS-HELP you're looking at going into thousands of dollars of debt when you start an undergraduate degree – you need to develop that special skill set.

Basic skills

Firstly, attendance is vital. I know in the past I've said you may at times have to give preference to other commitments. When trying to create a

balance between study and the rest of your life, you need to think rationally. Work is important. If you're a full-time student living away from home and/or support other people, you may have to miss the odd lecture if a shift comes up. If you have some sort of medical problem, it's important you take care of that rather than wait until you have the 'free time'. Don't skip class for bullshit reasons, though. I remember when I took the second semester subject Data Communications, I hated it. Everyone hated it. The material was dry and the lecturer was possibly the most uninteresting man I've ever met. I frequently cut class not out of necessity, but because I was bored. I paid for it on the exam.

Reading the textbook is essential. Make the time to do it. Don't read late at night when the information simply isn't going to sink in. Read on the bus or train. Read during breaks in your daily schedule. Being familiar with the assigned reference material will give you the confidence to contribute in tutorials, ensuring you get a decent participation mark. It will also help significantly with assignments and exams. In my experience, lecturers write a lot of exam questions based directly on the textbook.

Building on the basics

The above is all well and good, but as I said earlier, reading the textbook and gracing tutorials with

A good starting point for alternative reading material is the 'recommended reads' list in the unit guide...



your presence isn't enough. If you're going to tutorials, you actually need to contribute to class discussions. Discussing ideas builds your confidence with them. If you have any misconceptions about the week's topic, the tutor will spot them and be able to address them immediately.

On the matter of books, some assigned textbooks are rubbish. Could be, they're recommended because the lecturer moonlights as an author. If you're dissatisfied with the assigned textbook, seek out alternative reading material. An hour at the campus library is bound to turn up something. Looking at Amazon.com or a similar site for reviews is always a good move. If the library doesn't have a book you know is good, you might be able to get a bookstore – on campus or somewhere in the local area – to order it in for you. A good starting point for alternative reading material is the 'recommended reads' list in the unit guide, which you should be looking at even if the assigned textbook is brilliant. Getting varying perspectives on a topic and hearing the widely accepted theories expressed in different ways will aid you in your learning. If there isn't a list of recommended readings, ask your tutor or lecturer if they know of any good books.

Help is available

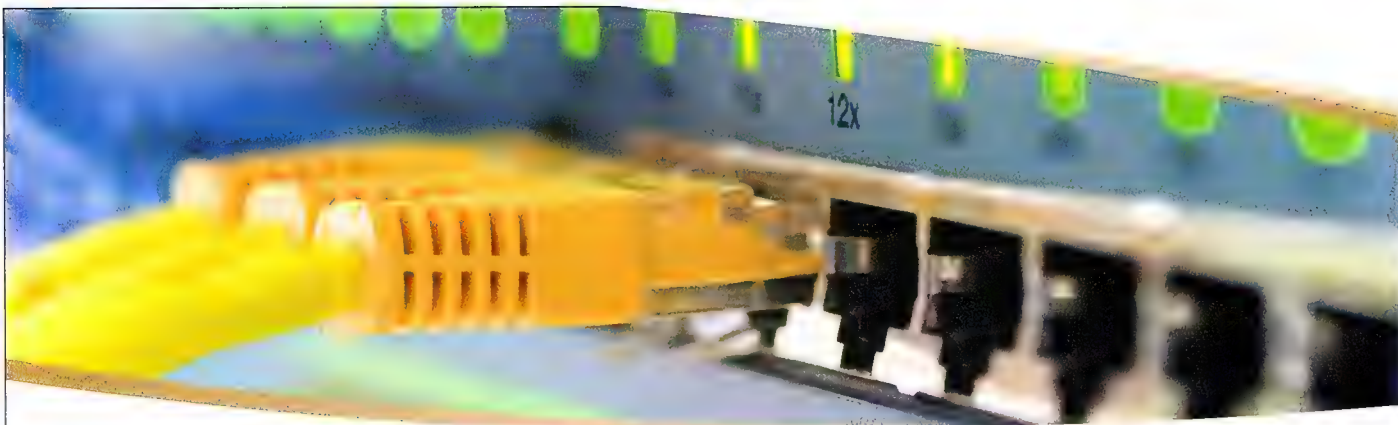
As much as the university system doesn't hold your hand, help is available. It's your job to acknowledge you need help and seek it out. All



universities provide resources on their websites that cover topics such as referencing sources in assignments. All universities run workshops that cover topics such as essay writing, public speaking and exam preparation. If you feel you struggle with a particular aspect of study, contact student services and find out what sort of assistance is available before you have major assignments or

exams to deal with. It's up to you to seek out the assistance and make the effort to actually attend any workshops or lectures that can provide you with useful information.

If written work proves to be a significant problem, it's up to you to take steps to address your weaknesses. Having brilliant ideas is all well and good, but you won't get marks



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for them if you can't express them coherently. A good investment would be a copy of William Strunk and E.B. White's *The Elements of Style*. All good bookshops will carry it, even though it's ancient. You will find it in the library. Yes, it's American, but it – along with a good dictionary – will improve your expression significantly. Strunk and White advocated a style of written communication that is logical and straight to the point. They believed a writer should never use two words when one will do. Their advice is very relevant to writing essays, making their slim volume an excellent investment.

If it's public speaking that's the issue, you will find a lot of books and websites that address the matter. The key is to have confidence in what you're going to say. The key to having that confidence is being familiar with what you're going to say. Read your notes over and over. Practice in front of the mirror or, if you're part of a group presentation, to your team mates. Try and reach the level where you know the material so well you only have to glance at your cue cards (never, ever stand up the front of the class with an A4 sheet) and can spend most of the speech looking at the audience. Consciously slow yourself down. If you think you're speaking a little bit fast, you're probably speaking incoherently fast.

Referencing is something a lot of newcomers to university struggle with. Your faculty will prob-

ably suggest you use a certain style – Harvard or APA, perhaps. The university will no doubt publish a guide, both online and in print, to using this style in your assignments. If you're not provided with a copy of it, it's your job to seek it out and familiarise yourself with referencing in that style before you lose marks or, worse, get in trouble for plagiarism. In addition to learning the style of referencing, familiarise yourself with the restrictions on the amount of copyrighted material you're allowed to directly quote and so on. Depending on the faculty and the purpose of the work, this can vary.

Group work

Whether you're studying arts, engineering or information technology, at some point you will have to work in a group. Don't bitch and cry about it, as eventually you'll have to do it in the real world. Those same lazy, incompetent people who sit in your tutorial, wasting everyone's time, will one day be your colleagues. Deal with it.

If you're in a group situation, you need to be firm. Don't be a dick from the outset, but everyone in the group should make it clear what they expect from everyone else. If someone

everyone's work and ensuring the end product is concise and coherent. You get the idea. If people are comfortable with the tasks they've been assigned, they're more likely – in theory, at least – to do them to a respectable standard.

If you have problems with someone in the group speak to the person in a firm, but not confronting, way. Don't call them a retard and expect them to then dance to your tune. If they don't smarten up, go as a group to see your tutor or lecturer. Don't simply bitch about the problem with each other. Grow some stones and seek assistance. It's worthwhile doing this even if you're being marked individually, as the annoyance and stress generated by an uncooperative team mate can drag you down.

Exams

If you've maintained good study habits throughout the semester, exam time shouldn't be stressful. If you don't know the material a week out from the exam, you'll never know it. Cramming isn't necessary if you're comfortable that you've read as much as you can, attended and participated in every tutorial and taken steps to address any weaknesses you have as

Consciously slow yourself down. If you think you're speaking a little bit fast, you're probably speaking incoherently fast.

admits to having a particular weakness, try and work around it. If they consider themselves a terrible public speaker, you can't expect good results if you push them to deliver the majority of the presentation. So too with strengths. If someone has a good grasp of spelling and grammar, give them one less topic to research so they can invest more energy in proofreading

a student. Your best bet is to revisit your notes and, if you're struggled with a particular topic in the class, any relevant readings or weekly tasks. Your lecturer may direct you to old exam papers, which is generally a hint that some questions on the exam may be recycled from previous years. Be sure to read over any old exams you can get your hands on.



No girls allowed!



EA seems to think all gamers are Neanderthal heterosexual guys; the way it's going, it might get its wish...

I've got a story about two companies, one of whom got it very, very wrong, and the other of whom got things very right indeed. Compare and contrast EA and ThinkGeek.

EA had an awesome competition at San Diego Comic-Con. Awesome, that is, if you're a straight dude who's okay with sexually harassing women.

You 'commit acts of lust' with a booth babe (not just an EA booth babe who might actually be prepared for the assault, oh no) to win a dinner and 'sinful night with two hot girls, a limo service,

women's bodies.

EA gave tacit approval for unacceptable behaviour to the yobs and yahoos out there who get off on harassing women. It's almost like EA knew nothing about the ongoing issues with sexual harassment that some women have suffered at previous Comic-Cons. Did they miss a memo after the drama last year? (You can get a breakdown at <http://bullyscomics.blogspot.com/2008/08/serious-note.html>, which also points to some of the ensuing pressure that

'1-up' shirt is now available as a polo. For those of us who have the 'Huge Tracts of Land' that one ThinkGeek t-shirt advertises, there's now a t-shirt that manages to contain those huge tracts of land in a flattering way. That they've done this in response to feedback from their buying public just makes it all the better. Now, who's for a letter campaign to get some more classic cut women's ThinkGeek shirts?

And finally, a study from Michigan State University has found a troubling disparity in the number of women videogaming compared to guys. They decided to try and uncover the reasons why and found that women have 16 hours less free time each week at university – spending it instead on jobs, homework and other activities. This, say the study's authors, could be a big issue when it comes to the technology gender gap. On the bright side, time spent gaming doesn't appear to affect grades, so get playing... just avoid any EA games, okay? (S)

Zara Baxter is really pleased to have used the words 'hyperinflated', 'munchkin' and 'wankery' in this column, but is sad that they're not all in the same sentence..

zbaxter@pcauthority.com.au

Whenever anyone asks you why more girls don't get game... point them at this kind of stunt...

paparazzi and a 'chest full of booty'. No prizes for guessing that the double entendre of 'booty' was intended, especially since the tagline 'dinner, booty and more' was plastered across cleavage on the poster advertising the competition. Way to stay classy, EA.

After a few days of being treated like so much meat for the drooling morons keen to win, I'm sure the booth babes are just dying to spend some quality time with one. Especially if that winner thought the 'booty, and more' entitled them to some action with their date. Yuk. Did nobody think through that you're basically offering up two women as eye-candy for an evening (oh, how appealing for those women) or for something potentially more dangerous? Whenever anyone asks you why more girls don't game, get involved in comics and the like, point them at this kind of stunt as evidence that, at times, the entire industry can be hostile to women. Would you feel safe being a woman at Comic-Con with this kind of thing happening around you? What if some bozo decides that you're his preferred target for an act of lust to catch on camera?

The fine print on the poster reveals that there are further contest rules on twitter, which helpfully mention that the 'acts of lust' are just a photograph – no actual acts of lust required. I'm sure that's a relief for any unsuspecting booth babe groped by an overenthusiastic munchkin with a hyperinflated sense of entitlement to

various women's groups applied to Comic-Con to institute a sexual harassment policy and the formation of the Con Anti-Harassment Project at www.cahp.girl-wonder.org.)

Of course, it's not just women who get the big 'not welcome' mat. Most guys (including the Atomic Team, Ars Technica, The Escapist and more) also found the whole thing entirely distasteful. Respecting women is kinda standard for the majority of geek guys. Being tarred with this kind of wankery doesn't help male comic fans get past the stereotypical image of the sad loser who can't get girls, even though we all know that's utter rubbish.

So it's FAIL on all fronts for EA. Golf-clap.

As a happy ending to this, gay gamer PixelPoet entered using photos of guys around the con, came runner-up and declined his prize. "I became aware of your contest through one of the many blogs decrying it. I think the contest was somewhat sexist, misogynist, and exploitive, especially since you were sending fans upon ANY booth babe at SDCC; however, as a gay man, I also saw this PR stunt as a missed opportunity that resulted in what appears to be a narrow minded view as to what your game's audience can truly be."

So, over to ThinkGeek, where the women's t-shirt range has expanded (no pun intended) its selection of sizes, and now has more styles than the 'babydoll tee'. The 'OMG Pwnies' shirt can now be found in classic cut, and the mushroom





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GAMEPLAY

GAMES, GAMING AND FILM COVERED... ATOMIC-STYLE

We're heading into the pre-Xmas slump at the moment, so our game count is a little down this month. But that's okay, because that huge rush of big games is just around the corner!

Of course, that's not to say we're leaving you empty-handed.

Engine Room this month gets down and cell-shaded with Gearbox honcho Randy Pitchford, as he waxes lyrical about the upcoming

Borderlands. He's excited, we're excited, and we think you'll be excited too.

Then we delve into the gritty military realism of ArmA II, get the crap beaten out of us by orcs and elves in Bloodbowl, and, finally, we've actually found a Wii game that excites us. Really!

We also take time out to chat to Jamie Bamber of Battlestar Galactica fame, catch up with a classic western, and then Justin leaves us with some thoughts on extreme cooling...

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Borderlands

From its tasty 'concept art' style to its millions of guns, Seamus Byrne shows how new ideas were blended with gameplay to offer a fresh take on the FPS-RPG genre.

On first looking into Borderlands, it's hard to ignore similarities to games like Fallout 3. The blend of first-person shooter and role playing game angles, for starters, plus what at initial glance looks like a post-apocalyptic setting. But once you start digging a little beyond the stylish graphical veneer you quickly realise this is no clone.

"I think it's safe to say that if you liked the theme and setting in Fallout 3, you'll really appreciate Borderlands," says Randy Pitchford, President of Gearbox Software, maker of Borderlands and also known for the Brothers in Arms series. "I think it's also safe to say that if you played Fallout 3 and wished that the game featured co-operative play so you could join up with friends or if you wished that there were vehicles you could drive around in or if you prefer a little more action and a little less digging through dialogue trees with NPCs, you'll LOVE Borderlands."

So what is the Borderlands story? According to Pitchford, you're role is a mix of Mad Max and Indiana Jones. You play a treasure hunter on a doomed planet, Pandora, looking for a legendary alien Vault believed to contain artefacts of limitless power and value.

"The Vault is sort of your Lost Ark and you're in a race to discover it. Fellow Vault hunters can

join you co-operatively on your quest," says Pitchford. "Along the way you'll befriend settlers, protect them from wicked bandit leaders and other unsavoury forces and beasts that make life on Pandora extremely difficult."

Pitchford then elaborates on what 'a little more action' means in how Gearbox has built its take on the FPS-RPG concept.

"Fundamentally, the design goal of

Borderlands is to start with the foundation of an extremely tight shooter. Great controls, great gun play, great feedback. The same solid FPS fundamentals that are behind the most successful FPS games," says Pitchford. "On top, we wanted to layer in some of the compulsion and motivation we get when we level up, gain skills and hunt for better and better loot when we play games like Diablo."





However, that additive progression process can often lack inherent entertainment value in many RPGs, so we quickly learn to resent the grind. Pitchford sees the added focus on a polished FPS as a possible solution to make for a fun process of character development.

"Applying that drive to a fundamentally fun and engaging skill test, like the combat loop in a solid first person shooter, was the plan. It took us some time early on to get it, but we got it and it's tight. *Borderlands* is fun combat in and of itself. And the loot and growth and character development is also extremely compelling in and of itself. Together, it's just a huge amount of fun and a great value."

There seems to be an industry trend toward blending first person shooters and role playing concepts, and Pitchford agrees the two genres are in the process of merging right now. But he sees there is a key difference in how Gearbox has approached this merger that gives *Borderlands* something special.

"Most of the folks are coming from the RPG



angle. Games like *Fallout* and *Mass Effect*," says Pitchford. "*Borderlands* is very clearly merging the genres from the shooter angle. It's just the deepest, richest shooter on the platform. I'm talking about character choice and growth and skills and loot and stuff."

"I'm not talking about story or cut scenes or dialogue trees or any of that. That's where RPGs slow the action down. *Borderlands* is fast paced and high energy. It's loose and fun, but big and wild. A place to get lost in and have fun in."

One of the refreshing parts of talking to Pitchford about his company's new game is hearing how comfortable he is talking about the inspiration they have drawn from other



games, and how these different ideas come together in *Borderlands*. So many companies feel so compelled to focus on what makes them different they can often end up sounding the same. Through his easy attitude to discussing his gaming influences, it becomes easier to see how Gearbox has built upon positive inspiration to arrive at a unique and engaging new game.

"I think *Borderlands* is a great example of how to draw from influences," Pitchford explains. "I

"I'm talking about character choice and growth and skills and loot and stuff."





"There are imbalances that can happen and to some extent, that's okay."

think it is exceptionally intelligent to say, 'Hey, if you're comfortable with the controls in Call of Duty 4, you're going to feel right at home with Borderlands.' Then when you show the original world and premise, it's easy for people to see that and know they're going to be comfortable and have a great game experience in that amazing new world."

Gunplay for fun and profit

One tasty treat in *Borderlands* is a massive random item system that will keep your characters arming and re-arming as they grow.

The 'Gear Builder' AI behind the item generator holds a potential offering of millions of weapons. Manufacturers, materials, weapon classifications, components, and the rest are all there to structure how the AI generates its weapon selections, and it can generate new items for loot drops in real-time as needed.

"There are some unique weapons, though," says Pitchford. "Some specific weapons that our human weapons designers have gone in and spec'd out and named and such. Those tend to be the most epic and valuable weapons in the game. We do anticipate that some of the really rare stuff is going to become very valuable."

And where there's value and there's co-op

and multiplayer interaction, there's going to be some trade lost. While things will run pretty free and easy at first, Pitchford sees that they will need to watch how things evolve.

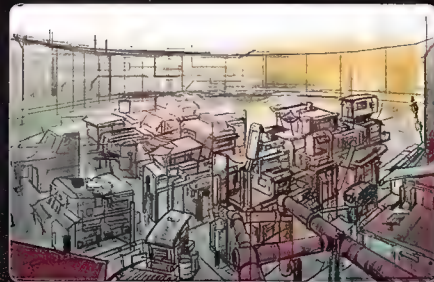
"You can work out trades with your friends and toss weapons onto the ground for others to pick up," he says. "If it gets out of hand with controversy or if the economy becomes really substantial, we'll have to look at doing updates or something to bring new features in-line with priorities of what's important to our customers."

The other possibility of a random item system is when the wheels of randomisation come up all 7s, and deliver a player some kind of uber-gun. You can't help but wonder what Gearbox has done to manage this potential for imbalance.

"Balancing the game IS quite a challenge, but with challenge comes opportunity," says Pitchford. "There are imbalances that can happen and to some extent, that's okay. If you get lucky and find an over powered weapon from some poor bandit you killed, well, you earned that — have fun!"

Changing times

If you've followed the development of *Borderlands* for more than a few months, you'll have seen by now that there was a significant





make a decision. When I went into the meeting, I expected to shut them down. Whatever it was, and I hadn't seen it yet, had to be too crazy. We were in production, after all. When I saw it, I was immediately struck. It looked awesome. I was in."

Looking at the size and scope of the world of Borderlands, along with drop-in, drop-out co-op options, there's a lot more in store than just a straight up single player game. Pitchford explains that the main mission chains offer gameplay on par with a longer first person shooter experience, plus side missions and optional challenges that offer more gameplay than the entire main-line of missions. And with four unique characters on offer, you can spend additional time playing and building up each of these individual characters. For even more fun, when you've completed the entire game you can start again in what Pitchford describes as a 'new game plus' mode for an extra challenge.

And then, for those who love to fight, there's the PvP.

"There are a few ways for people to engage in combat," says Pitchford. "You can challenge another player to a duel anywhere in the world, for starters. Or, you can head into one of the arenas and set up more organised matches of deathmatch or team deathmatch in battlegrounds that are designed for competitive multiplayer."

If all goes well for Borderlands at the registers, this won't be the last we'll see of this world either.

"If people want more, I think we'll be excited to offer some future expansions to the game. We'll have to make those decisions when it comes time, but I know there are a lot of people at Gearbox that are excited about that." 



shift in the art style used in the game. Earlier on, the game looked much like many other shooters. Gritty, grey, brown, and... did we say gritty? When the new style emerged just before E3 Borderlands made an instant shift from 'yet another' territory to a real head turner. Where did this shift in direction come from?

"The whole set of events that led to the art direction change was crazy. It almost didn't happen. I was going to shut it down," says Pitchford. "Here's what happened, as best as I can recall."

"We made some decisions in 2008 to make the game bigger and better. For example, we added a fourth character and we really expanded out the world a lot. We also committed to a robust skills system with the characters and some other details that really have brought Borderlands into its own as a game. But with those decisions came moving the game's launch into 2009. Much of the art was finished and I think some of the artists were thinking, 'What are we going to do?' A few artists, including one of my business partners, Brian Martel, were looking at the original concept art for the game and some of the early inspirations for the visuals and began tinkering

with how to render that kind of look in real time."

"At first, I didn't know what they were doing, only that they were being radical and that the implications of what they proposed was going to change the art direction entirely. Brian and I agreed that they could work on a prototype for a few weeks and then we'd look at it and





Arma II

Incredible accuracy and military depth... but at what cost?

Arma II splits our critical reasoning right down the middle, like it's been blown in two by a well-placed sniper shot.

On the one hand, you have a classically hardcore PC military sim with more vehicles than you poke a LAW at, a wide open environment, and killer multiplayer. Then, on the other, you've got a deeply flawed and buggy codebase and enormous system requirements.

To put it bluntly, Arma II is a game that's easy to love, but very hard to actually like.

The Arma series comes from deep inside serious-sim territory. As wonderful a game as Call of Duty 4 is in many respects, Arma II smacks it upside the head so hard with the realism stick that it may as well be Starfox. In Arma, real ballistics are a harsh mistress to wannabe snipers, and even taking down unaware guards with your trusty M4 Carbine becomes a game of skill. This, combined with the vast open spaces of an entire island to play with (the fictitious Chernarus), means that Arma is as much a game requiring vast patience as it is intense skill.

And a really good rig – even our beefy 4870X2-powered NRG rigs struggled with this on reasonable settings.

The single-player campaign starts off with the usual beats: a US taskforce is heading into this Eastern European island to head off... well... some baddies. The early mission briefings are

delivered with such leaden prose that it's kind of hard to pay attention. But, eventually, you're choppered out to your dropzone, and you can get down to some good small unit action – you start as a simple soldier, but you'll progress through various levels of command and control as the campaign progresses.

The first mission also highlights some of the game's other strengths – you're on the ground to call in a missile strike on a comms facility, but it turns out it's within a populated village. So what do you do? Well, personally, we went in to scope the situation and see if placing charges would do the trick, which in turn opened up another mission as we discovered a local doctor being held hostage. Again, it's up to you to free him or stick to mission parameters, but that kind of organically evolving mission (we could have easily missed the doc) really helps the old immersion levels.

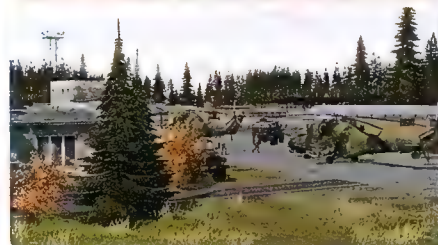
What doesn't help the immersion levels are the aforementioned horrendous dialogue, and that's even assuming the correct dialogue files actually play...

At this point, we really have to admit that we didn't get much farther into the campaign. There's only so many times I can hear my squadmates call out "There. Is. A... MAN at... HOUSE."

Procedural dialogue FAIL.

But that's just one of many fails throughout the game – from dodgy ATI support, to random and often strange examples of vehicle physics, this game frustrates almost as much as it exhilarates. Just a quick scan of the official forums reveals legions of fans who, like Mulder, just want to believe in the game – if only they could play it.

But if you strip out the friendly AI by getting into a co-op mission with some mates, Arma II can really deliver the goods. Few games have provided the level of tactical involvement



– Operation Flashpoint, which was a Bohemia Interactive title before Codemasters took it over, comes to mind – and depth that Arma offers. In fact, most of that entertainment comes from the intense discussions you'll have with your squadmates as you discuss how to tackle the evolving mission – the tense action and pyrotechnics of combat is just the icing on the cake.

Essentially, Arma II is a game that you really need to meet halfway – it won't do all the entertaining by itself, and it asks a lot of commitment from gamers to get the best out of it. It's deep and often too complex, but it can be infinitely rewarding. **DH**

PC

Developer Bohemia Interactive Studio
Publisher All Interactive Entertainment
Website <http://www.arma2.com/>

Graphics
Very good, but very demanding.

89

Gameplay
Challenging – when it works.
Multiplayer is awesome.

78

Sound
Weak voice and scripting.

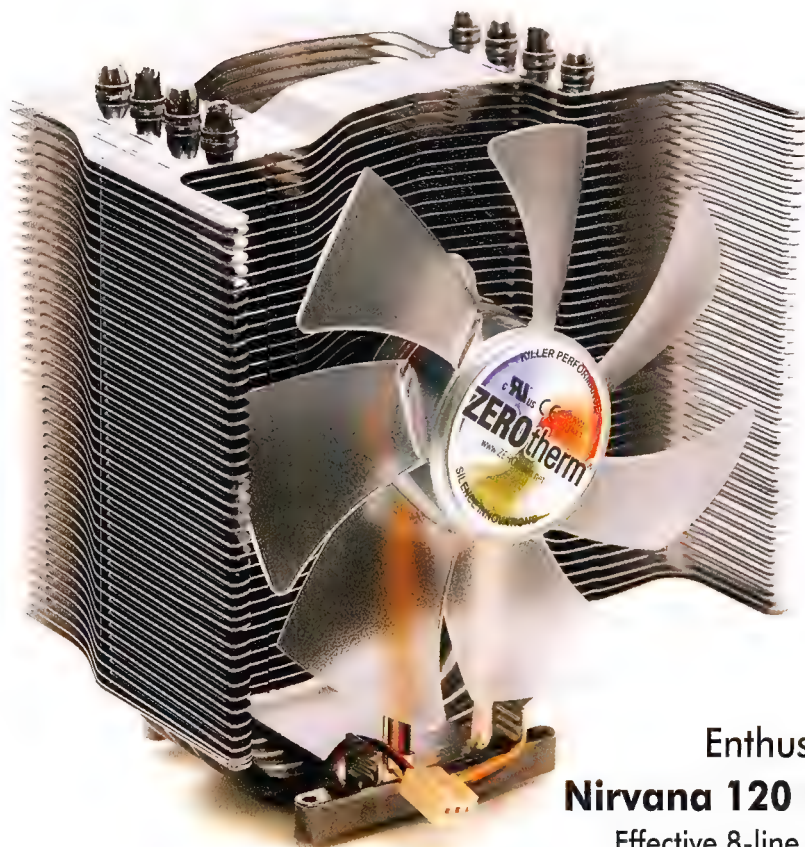
68

Overall
Could have been a great game with more dev time.

73%



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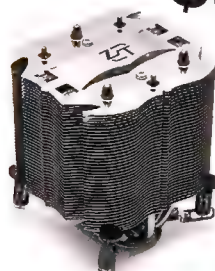
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Bloodbowl

Does the full game live up to the fantasy football hype?

There are few pleasures more simple than beating the crap out of an orc with a giant walking tree, while your lightfooted wood elf catcher sprints downfield to score a well-deserved touchdown. At the heart of it, Bloodbowl delivers some crazy fantasy football action, wrapped up in a basic football manager type campaign, but as good as the core game is – and it's hella fun – there's some tarnish on the old Bloodbowl trophy.

First up – you're really going to want to be a fan, because the amateur UI and loooong load times really well put off the uninitiated. In fact, we've painted entire teams in the time it takes some games to load!

(Okay, admittedly, not painted particularly well – but you get the idea)

That same sense of afterthought kludge affects the multiplayer play, as well – there are numerous open and private leagues you can play in, which

is a neat touch, but you can't simply play directly with a friend without both being part of the same league. The extra step is annoying.

At least LAN play via IP is possible, which at least puts Bloodbowl ahead of Starcraft 2...

And yet, for all the woes surrounding the game, we're still addicted – the animations and models for all the races are wonderfully characterful, the gameplay is tense and rewarding, and the humour of the original boardgame comes across wonderfully. Once you do get online and find league, playing against a live opponent is even better – this is the way the game's always been meant to be played, and the addition of hotseat play is a lo-fi but welcome addition that doesn't detract from the game at all.

Bloodbowl may not have the broad appeal of other GW table-to-PC games, but the game still has unmistakable charm and a lot to recommend it – especially to those of a nostalgic bent. **DH**



Overall
Rife with minor issues, but the core is hella fun.

78%



Red Steel 2

Yes... we're reviewing a Wii game... but it's cool, honest!

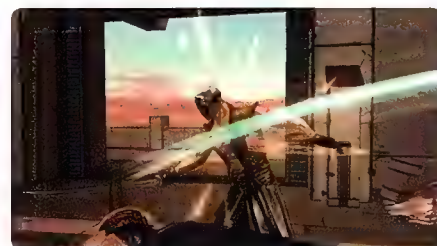
It's okay, don't worry – we're not going all casual gamer on you! But we are honestly intrigued by this sequel to one of the Wii's biggest launch titles, Red Steel.

Red Steel 2, while a sequel technically, is practically a whole other game. Gone is any pretense to 'realistic' graphics, and in its place is a grim cell-shaded world more like a comic-book than a game. Also, there's the setting: Red Steel was set in the real world, where as Red Steel 2 is more of a Mad Max meets a Western meets a Samurai vibe.

Interested yet?

Even more intriguingly, Red Steel 2 makes good use of the new MotionPlus controller to really get you feeling like a sword-swinging mofo. We got a chance to play just a limited portion of the game following E3, and, to be honest, it was a blast.

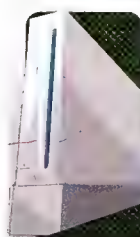
The thing which always annoyed us about Wii games was that the motions you went through to play a game rarely mapped in any meaningful way in-game. The new controller changes that, however. Red Steel 2 simply picks up your arm and hand movements and translates them near perfectly in-game. One key-press modifies



you into a blocking stance, but that too maps your movements. The strength behind a blow is also measured, so with one well-placed, well-weighted sweep you can knock back three or more foes; combine that with maneuvering via the X/Y controls, and you have a very agile, very accurate swordplay simulator!

Of course, as much fun as Red Steel and its grimy Western via Tokyo setting is, this control schema really cries out for one thing – a proper Jedi fighting game.

But in the meantime, this is the next best, and a surprisingly entertaining, thing. **DH**



Anticipation rating
We're quietly looking forward to more slashing and maiming action.

81%

Strategy without tactics
is the slowest route to victory.

Tactics without strategy
is the noise before defeat.

Sun Tsu -
Author - *The Art of War*

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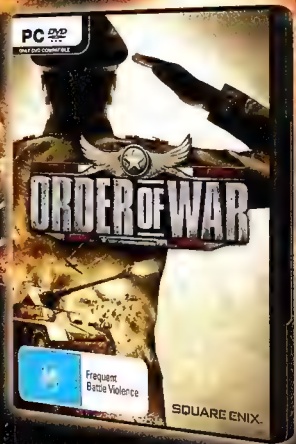
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SQUARE ENIX

Battlestar Galactica's Jamie Bamber

BSG's Apollo on the complete show, cop shows, and much more....

No doubt, March 20, 2009 will be a date forever ingrained in Jamie Bamber's mind. It was the day that the final ever episode of *Battlestar Galactica* first aired. For the British-born Bamber, playing Captain Lee 'Apollo' Adama in Ronald D. Moore's stunning re-imagining of the famous 1970s sci-fi show has been like a dream come true. Since graduating from the London Academy of Music and Drama, Bamber has more than served his time in a series of television shows that might be regarded as a rites of passage for any British actor. Making appearances in *Hornblower* and Agatha Christie drama *The Murder of Roger Ackroyd*, he looked destined for a career in starchy period pieces – until he auditioned for the role of Apollo in Moore's 2003 three-hour mini-series that ultimately acted as a pilot for the subsequent four seasons. Following a group of humans aboard the eponymous spacecraft after escaping destruction at the hands of a cybernetic race known as the Cylons, *Battlestar Galactica* has become increasingly regarded as one of the most compelling shows of the last few years. As for the 36 year-old Bamber, whose real-life wife Kerry Norton has made several appearances in the show as paramedic Layne Ishay, his performance as the estranged son to Commander William Adama (Edward James Olmos) remains one of the chief reasons to keep watching. Below he explains how he feels as one of the greatest sci-fi shows ever made has drawn to a close.

Q: It must be very strange. The show is now finished but it's picking up more and more fans all the time?

A: Strange, yeah, but that's what we always wanted. We were always on slightly parochial networks and stuff. For example, I've just fallen in love with *The Wire*, and watched the first season, five years after it aired on HBO. And there's an awareness that TV's changing, and then if you make something good and unique – and we believe are show to be that – people can discover it in fifty years time. I know this is the last DVD launch, because now they're all out there, so this was always going to be a big occasion. It's an opportunity to spread the good news, as it were, of this show.

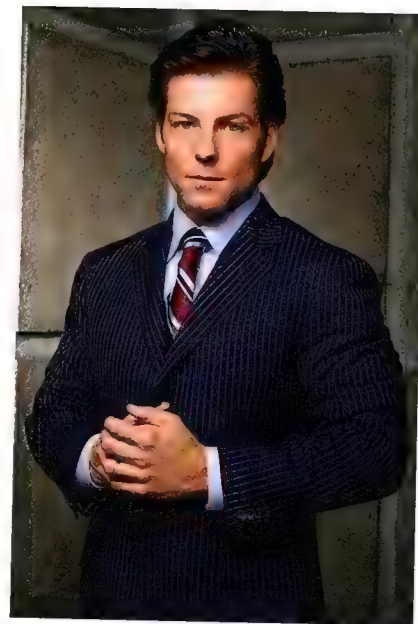
Q: Have you seen it getting more and more popular as time has gone on?

A: Oh, definitely. But that is the nature of

television. It always works in that way. When the first episode of any show goes out, it takes a long time for it to seep into the public awareness because it hasn't been rubber-stamped as a success or a hit – and that takes time. With our show, we're an idiosyncratic show anyway – it's got a goofy title that a lot of people will be turned off by. The fact that it's on Sci-Fi channel, and its always on a slightly ancillary network... it takes a long time for those things to hit the mainstream and to be regarded universally and for people to fall in love with it. I'm aware so much more now that the show's off the air that it's an important show than I was when it was on the air.

Q: Is it also that the show's original 1978 source was a bit hokey?

A: I think that lessens daily. Certainly when we started, that was the big elephant in the room – this original show. So there was a bunch of the hardcore fans out there going, 'How dare we re-imagine perfection?' And with the rest of the world, it was 'Why would you?' But the one thing it did give you was a bit of anticipation value. For those people that say 'How dare you?', they want to shoot you down. They want to see it so they can ridicule it. And the people who say 'Why would you?' they're much harder



to win over, because they're antipathetic. But at least there's an angle for the press, for example, to come at – which all remakes have in their favour for a while, if you do a good job. But the thing about it now is that we're not really fighting that anymore. We've made 78 hours of television, and I think they made 20.

We've told this story in a more resolved, fuller way than the original. In a way, the conversation has moved on; people are more aware of our show than they ever were of the original.

It's going to be hard to ever experience anything quite like this show.



Q: Was there a feeling of sadness for you when you got to the final season?

A: I always liken it to running a marathon. It's the satisfaction that comes with crossing a finish line. Our show was never going to be like an ER that could just go on and on forever. It really lives and dies by the conclusion at the end of this huge odyssey, and if it doesn't end, then the journey has no meaning. So we needed the ending to really validate the mythology of the show. When we got there, it was a real sense of satisfaction and achievement. But that inevitably becomes nostalgia very quickly and you realise you may never capture that kind of reward and work environment or excitement again. It's going to be very hard to ever experience anything quite like this show. I think it's almost unique.

But that really is all down to the fact that it is perfect and it is finished, and it has a unity and a structure that makes it better than if it otherwise be if it was still going.

Q: How quickly did you know when it was going to end?

A: I think I knew from before the writer's strike hit – at the end of Season 3. I knew that Ron had gone to the network and said, "I want a two year pick-up" – in the way that J.J. Abrams had got for *Lost*. He wanted five seasons, and they said they were unable to guarantee a two-year pick-up, so at that point he chose to guarantee a four – and end it in four – and the network were shocked. They said, "Why are you going to do that?" And he said, "I need to end the show. I need to do this right. I need to do it in the time frame that I understand before we get there. And not be caught short and having to wrap everything up in an hour special." So we knew very early that it was going to be four seasons and out. But then the writer's strike threw a spanner in the works.

Q: Why was that?

A: Because when we wrapped episode 4:13, there was a real chance we would never come back to finish the show. If the writer's strike had gone on much longer, I think it would've been impossible to make it work financially to come back and finish it, and that would've been the end. So it became slightly anxious there for a bit.

Q: Did it make it easier, knowing the end was in sight, playing your character?

A: Well, it certainly upped the stakes. When you realise this is the last time you'll have a scene on this set or with this character, there's a certain importance that that scene carries then that concentrates the mind. You watch a tennis match and a potential match point is played with much more urgency – and normally better – than the first point in the match. And that's just the way it is.

For the complete interview – it's a long one! – go to www.atomicmpc.com.au/?151090

All four seasons of *Battlestar Galactica* are now available on DVD, and a Blu-ray set is coming very soon. **DH**

DISC OF THE MONTH

How the West Was Won



This might seem an odd pick for Disc of the Month. We get a lot of material to go through each issue, from Doctor Who to anime and more, so going with an old-timey western classic is a touch left-field. But of all the films we've looked at recently, this is the one that really gripped us.

Made back in 1962, *How the West Was Won* is as famous for its huge cast (luminaries like John Wayne, James Stewart and Henry Fonda have what are effectively bit-parts), as it is for its almost unique three-strip Cinerama process. This was initially designed to project three segments of film onto a curved screen – a wrap-around process. In the cinema it was apparently stunning, but it's only now on Warner's latest release that the process actually looks good on the small screen.

The Blu-ray version we gleefully watched features two versions – one with a 'normal' 2.89:1 ratio, and the other in what's called Smile-o-vision, a curved ratio that mimics the wraparound of the original. It sounds gimmicky, but it really is a wonderful effect. The broad landscapes of the American west are simply stunning, and if the acting



and scripting is a touch corny, it's still remarkable film to look at – if only from a technical and historical perspective.

The film's split into five segments, split up between three directors and about five DPs – this was a giant production! It stretches from 1839 and the first rush towards the US west coast, and ends in the 1880s with the outlaw era. The films paints each epoch of the west pretty broadly, but there's certainly charm to the film. That said, it's hardly a historical document, and it plays fast and loose with how both the indigenous peoples of the area were dealt with, and with the importance of groups such as the Chinese to the western expansion.

But in the end, *How the West Was Won* does what it promises – it entertains. And come on... you have to watch anything filmed in Smile-o-vision! **DH**



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Well, ain't that cool

Justin Robinson does his cooling the dodgy way.

It's a situation that most of you have probably gotten yourselves into at one time or another, where you suddenly find yourself getting a little hot under the hood of your rig – but minus the requisite cash and/or effort needed to fix the problem properly. You'll wrack your brain, wallet or neighbour for any quick solution to it, even going so far as to check for change underneath the couch cushions, but eventually you'll give in to the inevitable.

Knowing that we've exhausted any reasonable or sane ways of getting it done, the most logical choice available is to simply ignore the problem in the hopes it'll go away by itself. Unlike a disgruntled door-to-door salesman, if you leave these for too long you'll usually wind up with a bigger problem (rather than an angry letter on your doorstep). With no money and very little motivation that leaves you with only a few options.

The tried, true and tested method that most will pick is simply to take off the sidepanel of the case, point the nearest room fan at it and call it done. While this might work in some situations the amount of noise generated can be more distracting than having a pole-dancing midget with tourettes in the room – not to mention how much of a pain in the arse it is to have to cart all that with you to a LAN. Another solution that's pretty common is to simply grab one of those giant flexy silver tubes and hook it up to an air-conditioning vent, cut a giant hole in the case

(extra points are awarded for jagged edges from the dodgy tinsnips used) and just flood it with cooler-than-ambient air. Phase change cooling for the masses!

Something that I usually do myself is to just dip my hand into the box of fans and other useless things I've collected over the years spent playing with and harvesting computers, pull out a couple of cable ties and a fan, then proceed to stick them in places that no mere mortal should have ever stuck them. I've strapped fans to dead intel stock heatsinks, graphics cards (especially passive ones, defeating the purpose entirely), memory sticks – even power supplies don't manage to escape my wanton cable-tying rampages. As a strategy it actually makes a lot of sense, and once you've directly cooled all the components in the system with their own fan it can actually be cooled better than it was before the problem first reared its ugly head.

But what if I actually did have an uncomfortably large amount of money and effort? I've always wanted to be in this group but never seem to make it in. If I did make it into this incredibly exclusive club, I'd probably take the most annoying path and go the furthest distance out of my way just to get the simplest things done. Imagine I had a CPU overheating problem; a quick planetrip to Antarctica would sort that one out pretty quickly. If anything this is probably a good solution for most of the Linux fans out there – at least they'll have penguins around!

Some might be tempted to suggest outer space as another choice (assuming a couple hundred million bucks), and after all haven't we all heard about the freezingly dark recesses of space? Well actually that's a pretty silly idea, since the lack of an atmosphere to provide a medium to take the air away would mean that the already troublesome tech would simply cook itself to death. Of course the simple solution to this would be just to have the computer inside the spaceship with me, but the heat would build up very quickly in the small volume of air and make things incredibly uncomfortable for everyone inside.

Another option that makes a lot of sense, but still manages to make almost none at all, is to hop in a submarine and head to the depths of the ocean. Since the water about 4km underneath the surface of the sea sits at about three degrees, this would make the perfect solution for a watercooling loop – simply pump cool water in from one side of the sub and the heated water out the other side. Unfortunately this would also mean that the pipes would need a lot of reinforcement due to the huge pressure down there – the equivalent of about 400 atmospheres of pressure, or four hundred times the pressure you're feeling while reading this page.

Maybe these solutions aren't the best ones I could think of with spades of money, but they sure would be fun to try. Until then though, it's back to cable ties for me... ☹️



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